TOPICS OF THE MONTH

Chemical engineering education

THE tremendous shortage of chemical engineers in Britain is something which has only recently become widely recognised, but which calls for speedy and effective action if the position is to be improved in time to produce the desired effect on British industry. Industry itself can help—and is helping, by keeping up a number of training schemes, for instance—but a great deal depends on what educational authorities do about the matter.

The recent D.S.I.R. report on ' Chemical Engineering in the U.S.A.,' reviewed in these columns last month, emphasised the disparity, if any emphasis was needed, between the numbers of trained chemical engineers in the United States and in Britain. It shows also that the Americans have a vigorous and direct approach to educational problems, some aspects of which might profitably be given serious thought in other countries. Particularly important is the need to achieve the correct balance between theoretical and practical work.

The importance of the educational problem is shown by the fact that, just two years after the O.E.E.C. conference on a similar subject held in London and reported in CHEMICAL & PROCESS ENGINEERING, 1955, **36** (5), 175-183, the Institution of Chemical Engineers is to hold a symposium on ' Chemical Engineering Education ' in Birmingham on April 9 to 11. This symposium is most timely, and it is to be hoped that it will throw light on the problems of increasing the output of chemical engineers and of improving and streamlining training methods wherever necessary. It should be remembered, too, that there is a need for flexibility in educational programmes, to meet changes in technology and in the structure of industry.

To many, one of the disappointments of the 1955 O.E.E.C. conference was that discussion about education was hampered by the differing concepts of chemical engineering held by some delegates from the Continent; this obstacle, at least, should not present itself at the forthcoming symposium.

New home for Institution of Chemical Engineers

WITH chemical engineering education and organisation an urgent problem for Britain the importance of the Institution of Chemical Engineers as a vigorously active body needs no emphasis. The Institution's ample new premises in Belgrave Square, London, dignified but cheerful, give some measure of its growth during recent years and reflect its progressive outlook.

We were recently privileged to visit the new premises, in company with other members of the technical press, at the invitation of the president of the Institution, Mr. John A. Oriel, C.B.E., M.C. A tour of the premises enabled us to take a delight in the tasteful decorative scheme—the board room, the members' rest room and the library being particularly attractive.

Mr. Oriel points out that in Britain limited natural resources create a need to export those materials that are of greatest financial reward, and that there is a need to make the impact felt throughout the world of Britain's brilliant scientific research. He adds that, owing to the country's smallness and lack of natural resources, Britain's chemical engineers must stress new ideas rather than quantity.

Accidents and the chemical industry

THE view is gaining ground that the prevention of accidents goes hand in hand with the planning of production, so that the prevention of accidents and the drafting of safety regulations form part of the duties of management. Another fact that is being realised is that safety depends not only on technical devices and the suitability of the processes but also on the interrelationship of men and machines. This mutual relationship is most liable to be upset by accidents at work and occupational diseases, and every accident in a factory affects many more people than those directly involved. For this reason avoidance of accidents is one of the most important aims in works practice and should be constantly in mind.

These points were made in a lecture delivered in London recently by Prof. Dr. S. Balke at the invitation of the Association of British Chemical Manufacturers, whose activities in the furtherance of chemical works safety are well known. Prof. Balke's lecture revealed a great many interesting facts about safety in the chemical industry in Germany and certain other countries that are well worth studying; here we can only deal briefly with one or two points.

One fact to note is that accident figures relating to the chemical industry in Western Germany are considerably lower than the average of all industry. About 40 accidents occur in the chemical industry every million working hours. The figures for accidents on the roads are still rising very rapidly and it may be said that the real risk does not begin when the worker enters the factory gates—as it did in the past —but on his way to and from work.

Dr. Balke contends that the support given by the International Federation of Trade Unions to the reduction of working hours because of special hazards in the chemical industry is quite unjustified. Even if it is admitted that there is still room for improvement in the prevention of accidents and occupational disease in the chemical industry, there is no doubt that the

view that the world's chemical workers are exposed to worse conditions than the rest of the population is quite wrong.

Dealing with the limitations of statistical comparisons, Dr. Balke points out that mechanisation and automation are withdrawing numerous workers from formerly dangerous activities. In order to assess the efficiency of safety precautions, it is therefore necessary to consider statistical frequency of accidents in relation to the volume of production. In a number of countries, there is evidence that the number of works accidents per unit production has fallen substantially; the regrettable fact—and this, of course, has no direct connection—is that the number of accidents is still far too high having regard to the present level of technology.

In connection with precautions against chemical hazards in the factory, it should not be forgotten that laboratories are workshops in which the risk of accidents may arise. Instances have occurred to show that grave risks are taken in attempting to follow instructions given in scientific literature if the literature does not indicate that appropriate safety precautions should be taken or state that dangerous compounds may be produced in the experimental work. It is advisable to read right through the original papers to obtain information on the possible dangers of substances which may be used in experiments.

The value of the psychological approach to accident prevention was emphasised by Dr. Balke, and he also touched on the subject of occupational diseases and protection against radiation hazards. Finally he urged that the good safety record of the chemical industry should not be confined exclusively to large concerns. The ultimate target should be that the accident rate in each chemical factory should not exceed the lowest statistical figure.

Big chemical engineering deal in London

A SIGNIFICANT transfer of ownership in the field of chemical engineering was completed in London recently after the president of the powerful Electric Bond & Share Co., of New York, Mr. G. Walker, and his vice-president, Mr. L. Ginsburg, recently visited London in connection with the formation of a new company, Chemical Construction (Great Britain) Ltd. This company has absorbed the former engineering division of the American-owned Cyanamid Products Ltd., of London, whose personnel, with 20 years' experience in constructing plants throughout the sterling area, has also been taken over.

The big London take-over was duplicated some months ago in the U.S. when the Chemical Construction Corp., also formerly owned by American Cyanamid, was acquired by Electric Bond & Share. The 'twin' companies will collaborate closely in engineering design and plant construction for the chemical and petro-chemical industries, including plant for the production of nitric and sulphuric acids and synthetic fertilisers. Managing director of Chemical Construction (Great Britain) Ltd. is Mr. M. S. Henderson, who for many years, and until the end of 1955, was director of Cyanamid Products Ltd.

Some 25% of the world's synthetic ammonia and 35% of its sulphuric acid is today manufactured in plants engineered and built by the Chemical Construction organisation.

Helping the smaller firm

PLANS to place on an independent footing, and with its own management, the advisory service for industry that it has been running successfully for the past three years have been announced by the National Union of Manufacturers. The N.U.M.'s president, Mr. C. S. Garland, who is a chemical engineer, revealed that a new, non-profit-making organisation known as the National Union of Manufacturers' Advisory Service Ltd. has been formed to carry on the good work.

Aim of the advisory service is to help firms, and particularly smaller firms, to raise productivity and cut costs.

New horizons for bursting discs

INCREASING use of bursting discs in industry is reflected in the announcement that Marston Excelsior Ltd., of Wolverhampton, a subsidiary of Imperial Chemical Industries Ltd., has taken over from the Billingham Division of I.C.I. the manufacture of these ingenious safety devices for pressure vessels and plant systems. The firm is now able to hold out a wide range of sizes from $\frac{11}{16}$ in. to 5 ft. in diameter.

Even more interesting, perhaps, is that bursting discs can now be made from a range of materials, including copper, brass and the more precious metals such as platinum, palladium and gold, while non-metallic discs of rubber/canvas, neoprene and *Klingerite* are made. In addition, discs can be supplied coated with *Araldite*, *Hostaflon* and *Alkathene*, giving additional resistance to chemical attack. Marston Excelsior are also manufacturing carriers and vacuum supports to hold the discs in position.

It was in 1934 that the Billingham division of I.C.I. began to produce bursting discs for use in their own plant and for a number of plant users. Marston Excelsior therefore takes over considerable experience in this field. Records have been compiled of a wide range of discs and customers' particular requirements can always be met by reference to these records, while a fully qualified design staff is available for consultation.

Bursting discs can be used in any pressure system; by inserting a disc of sufficient size in the vessel wall, and by so designing it that rupture will occur when the pressure difference across the disc reaches a predetermined value, a complete safeguard is achieved. Replacement discs with exactly the same characteristics can be purchased and fitted when a disc is destroyed. Such replacements can be effected in the minimum of time and losses due to plant shut-down are much reduced, the destruction of capital plant being virtually eliminated.

Industrial and coal-tar chemicals and the U.S.

DESPITE the vast expansion in recent years of the American chemical-producing industry to meet the continually growing demands of the chemical-consuming industry, statistics of U.S. imports for the past six years show an upward trend, although there are fluctuations from year to year. Imports of industrial chemicals from the United Kingdom have averaged $6 million annually and statistics for the first half of 1956 show that imports are running at an appreciably higher rate than in previous years. The value of U.S. imports of British coal-tar chemicals has decreased annually since 1951, due mainly to the cessation of imports of benzene which the domestic industry now produces in increasing volume from petroleum sources. Nevertheless, the value of imports of coal-tar chemicals from the United Kingdom is still running at the rate of some $7½ million annually, representing an increase in imports of certain coal derivatives which offsets the decrease in imports of others now being produced in greater volume by the domestic industry.

Thus it appears that U.S. demands for consumption still exceed U.S. production with respect to many items of industrial and coal-tar chemicals, and that opportunities still exist to increase United Kingdom exports of some kinds of chemical products in competition with domestic or other foreign suppliers.

British chemical manufacturers interested in the U.S. market will find much useful information in a bulletin on this subject that has been issued by the Board of Trade (Ref. ESB/29524/56) and which gives tables showing the value, in thousands of dollars, of United States imports of industrial chemicals and coal-tar chemicals for the past six years. In addition, trade practices in the U.S. industry are discussed and the outlook for imports is summarised.

One important question is that of packaging and it is stressed that the exporter should not supply in packages of 'unusual' size. The standard British package of 112-lb. bags or 336-lb. drums, for example, is not popular. For dry chemicals, the standard package in the U.S. market is the 100-lb. multi-ply paper or burlap bag or fibre drum and, for liquid chemicals, drums of sizes varying from 50 to 700 lb. This standardisation permits greater ease of handling and, as a result, firms design their storage facilities to accommodate the average type of package handled.

Static hazards

MANY flammable liquids are insulators or only poor conductors and when pumped, poured, agitated or evaporated are liable to generate a charge of static electricity. The charge may be conveyed through delivery pipes into a receptacle in which, even if it is earthed, if the specific resistance is very high, a substantial potential gradient may persist across the surface.

This condition may produce a spark if the opportunity is provided, as, for example, the introduction of a metal dip-stick. Generation of static charges also increases with the rate of flow and the lowest practicable pumping speed should be employed, in the case of liquids of high dielectric value it being usual to restrict the rate of flow to 3 ft./sec. In this respect the advice given in a publication of the Fire Protection Association in Britain will be of interest to the members of the chemical and allied industries.

Another problem which it considers is that associated with road tankers fitted with non-conducting rubber tyres. These vehicles can accumulate large charges of static electricity whilst in motion and the problem is to discharge this accumulation without hazard. The use of a drag chain may under some circumstances be unreliable and this method has largely been superseded by the use of 'conducting rubber' tyres. In any case a fixed earthing point should be provided to which the tanker should be coupled prior to intake or delivery of flammable liquids.

It is also necessary to provide railway tank wagons with a fixed earthing point to which they can be bonded when filling and emptying, since earth contact with the rails is not always satisfactory. Another problem which may not at first appear obvious is that static electricity is liable to be generated in portable drums and containers during movement or transfer of their contents. If flammable liquids are involved and the containers are of metal, precautions similar to those adopted in connection with tank wagons should be taken.

Isotopes track down ocean sewage

VALUABLE information regarding rates of dilution and effusion of sewage effluent in ocean waters has been obtained by using radioactive isotopes to track the sewage field and measure its dilution.

The city of Los Angeles is engaged upon a major sewage expansion programme, of which an important phase is the disposal of effluent and sludge into Santa Monica Bay *via* large ocean outfalls. In one of the basic steps towards the programme, the Hancock foundation of the University of Southern California carried out a year's oceanographic study of the bay, during the course of which it became evident that conventional methods of measuring dilution of effluent in sea water were not sufficiently accurate for a project of this magnitude.

The services of the Nuclear Science & Engineering Corp., of Pittsburgh, Pennsylvania, were engaged to formulate a plan which would enable a given patch of sewage to be located and sampled and provide a means of measuring sewage dilution on the spot, the technique allowing measurements of dilution at least one part in 10,000. The isotope finally selected was scandium 46, which has a half-life of 75 days. In a two-day experiment, two monitoring ships, one of them carrying a watertight scintillation probe feeding an amplifier height analyser through 125 ft. of coaxial cable to measure the actual radioactivity in the water, tracked the sewage tagged with radioactivity and took continuous bacterial samples.

Samples of water taken at the beach and at various points in the bay were also counted. The limit of

sensitivity for these samples was equivalent to a dilution factor of about one part to 2,000. One beach sample showed a count which was considered significant. This was approximately 1/500,000 of the drinking water tolerance. No detectable activity was found in any of the bottom samples.

The programme as conducted is reported to have been highly successful. Results obtained are being incorporated into the final oceanographic study of Santa Monica Bay and it is felt that the information obtained in this experiment can be usefully applied to other localities.

Desert oil

A FACTOR that seems likely to have an important bearing on French chemical industries in the future is the nation's determination to exploit mineral and oil deposits in its overseas territories. We recently reported briefly on French plans for increased mining activity in the Sahara Desert (December 1956, page 425); meanwhile international conditions make the indigenous production of oil important to France. Thus, while oil exploration still goes on in France itself, interest has recently been stimulated in the Sahara, although M. A. Collot, manager of the State-sponsored Société Nationale de Recherche et d'Exploitation des Pétroles en Algérie, has stressed that it is still too early to estimate the finds in the Ouargla Basin. However, he considered it probable that the whole Sahara is an oil-bearing region.

So far three exploration drillings in this area have found oil strata, namely at Laghouat, Messaoud and Hassi R'mel. Attempts are now being made to determine the extent of the area and to assess to what degree the sandstone stratum is porous and oil bearing. It has been suggested that to be economic deposits must be at least 50 million tons.

The search is also proceeding in other parts of the area and hopeful indications have also been found farther to the south-east at Edjele and Tiguentourine by the Compagnie de Recherches et d'Exploitation de Pétrole du Sahara, while other work is being undertaken by the Compagnie Française des Pétroles (Algerie) in the same area. This last organisation is now seeking two new five-year exclusive exploration permits in Southern Algeria. One of these covers an area of 11,200 sq. km. and is known as Erg el Agreb, while the other, known as Borbane, covers an area of 6,500 sq. km.

It appears that there is a good chance that in the not so distant future France may be able to obtain a large part of the needs from this source. In fact it is considered that the natural gas could be brought into use fairly quickly and oil could be transported to the coast by 1962. In the meantime the French Government has set up a central body to co-ordinate the economic development of 3,600,000 sq. km. of the desert regions at present administratively attached to Algeria, part of Metropolitan France, and French West and Equatorial Africa.

Present tentative figures are that an investment of 150,000 million francs would be needed for a possible annual production of 10 million tons of oil and a daily output of 4 million cu. m. of natural gas.

Refractory linings from refuse

REFUSE from mineral-treating plants in north-eastern Florida may become a source of raw materials for making high-temperature industrial refractories, according to a Bureau of Mines report, released by the U.S. Department of the Interior, which gives details of laboratory tests at the Bureau's southern experiment station, Tuscaloosa, Alabama. High-grade kyanite-sillimanite products were recovered from tailings obtained at plants producing titanium and zirconium minerals in Florida's Jacksonville-Starke area.

The tests showed that these tailings—material rejected in concentrating the titanium and zirconium minerals—can be treated by magnetic separation and flotation to produce a concentrate containing nearly 96% kyanite and sillimanite. Both of these minerals could be used in making linings for high-temperature boilers as well as for heat-resistant brick and other materials employed in the ceramic, cement, metallurgical and glass industries.

Successful application of the combined magnetic separation and flotation process would yield several thousand tons of mixed kyanite and sillimanite a year. Recognising the potential value of the tailings, operators of Florida mineral plants now are stockpiling them.

No cost studies of the Bureau process were made, but the authors, J. S. Browning, B. H. Clemmons and T. L. McVay, note that it appears commercially feasible.

Chemical engineering problems in nuclear reactor design

IN this issue (page 73) we give details of some recent happenings in the atomic energy field in Britain; many people in industry are still not clear what the atomic energy programme entails and a useful summary of the progress that has been made was presented to representatives of industry at a recent conference at Harwell, when members of the staff of the United Kingdom Atomic Energy Authority described their work on advanced types of nuclear reactors. One interesting paper was given by Mr. R. Hurst, who gave an account of the problems involved in the design of a 100 mw. homogeneous aqueous reactor. In this system some of the most difficult problems are associated with the continuous fuel processing techniques which might be used and with the handling of the blanket 'slurries.' Similar problems were described by Mr. J. Smith in a paper on the liquid metal fuelled reactor in which bismuth may be used as the solvent metal: these reactors are similar in the sense that both will resemble large-scale chemical plant rather than conventional reactor systems. One very important problem in the development of the liquid metal fuelled reactor is the development of a graphite moderator which is impermeable; it is possible that a beryllium moderator may have to be used.

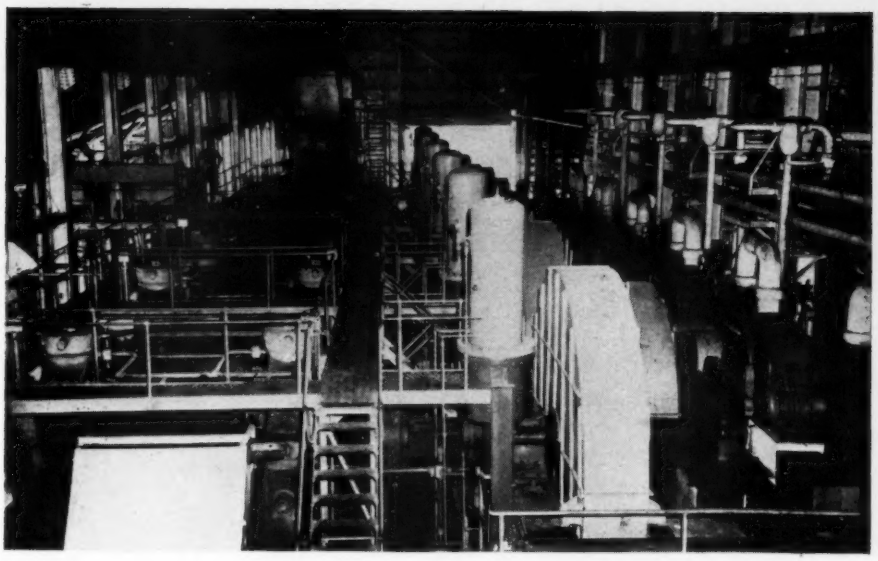


Fig. 1. An 18-roller, 34 in. × 66 in., turbine-driven milling plant with Maxwell shredder at Boca Chica, Dominican Republic.

SUGAR FROM CANE

By C. D. H. Vernon
(*George Fletcher & Co. Ltd.*)

The manufacture of sugar from cane has developed into a complicated, highly organised industry in which the various operations, including cane cutting, juice extraction, juice clarification and processing, evaporation, crystallisation, centrifuging, etc., are carried out in a closely integrated plant owing much to chemical engineering skill. This article describes the various operations and finally takes a quick look at the industry's future problems.

DURING the extraction of sugar from cane and beet, almost every chemical engineering operation is employed and the machinery required is therefore very varied in design. Sugar cane grows in tropical countries and contributes 65% of the world's sugar requirements, whereas sugar beet grows in a temperate climate and supplies the remaining 35%.

Cane is supplied to a factory by road, rail or boat, according to local conditions. It is transferred to a stack for temporary storage by a tower crane or gantry, or else it is placed directly on to a feed table or feed conveyor. It is then discharged on to a slat-type conveyor and passes under a leveller or a set of levelling knives which consolidates and levels the cane; it subsequently passes under heavy-duty knives which cut the cane stalks so that they form a compact blanket of finely sliced cane. Modern practice is to drive the cane conveyor through a variable-speed electro-magnetic slip coupling, the speed being suited to the quantity of cane on the conveyor as indicated by the load on the knife-set motors; the uneven loading of the conveyor is thus compensated by the adjustment to the rate of travel of the cane and choking of the knives is avoided.

The cut cane slides down a feed chute into the first mill or crusher. A magnetic separator of the revolving-drum or conveyor-head type is often inserted in this chute in order to remove tramp iron such as links from the cane sling chains, broken knives, etc., which would otherwise cause considerable damage to the grooving of the cast-iron shells of the mill rollers.

Juice extraction

The extraction of the juice from the cane is performed by a series of cane crushing mills (a typical milling plant is illustrated in Fig. 1). A mill consists of two massive cast-steel headstocks housing three rollers; these have forged-steel shafts on which cast-iron shells are shrunk.

The shaft journals run in water-cooled bearings, which may be either of bronze or of steel with a white metal or bronze liner. The rollers are grooved in order to grip the cane and break down the structure of the fibres. The first mill unit is known as a crusher and it may be preceded or followed by a shredder in order to get better preparation of the cane for juice extraction. The sugar is in solution in the juice which is contained in the fibrous cells of the cane and these must be ruptured before the juice can be squeezed out, thus, in addition to the knives already mentioned, many milling plants are fitted with shredders to obtain a more complete preparation of the cane.

Shredders of the swing-hammer or splitter types are generally used, the latter comprising a series of fixed knives on a rotating drum, so arranged as to give a very fine cutting pitch.

The top rollers are free to lift against hydraulic rams in order to adjust the opening between the rollers to the thickness of the cane blanket and so maintain an even pressure of maximum intensity. The load from the rams may be more than 100 tons/ft. of roller length on modern mills which have bearings of adequate size. When the spent cane has passed through the complete tandem of several mill units it is called bagasse and contains, roughly, half moisture and half cane fibre. This is fed to the boilers to provide fuel for steam raising, and is the only fuel required in the factory under normal conditions. Mill rollers rotate at 4 to 6 r.p.m., giving a peripheral speed of 35 to 50 ft./min.

In order to obtain the maximum amount of sucrose from the cane and yet cause the minimum dilution of juice by the addition of water, a system of compound imbibition is employed. The juice remaining in the cane contains a high percentage of sugar and, to obtain the maximum extraction, water is added to the crushed and partially exhausted bagasse and it is again crushed and the diluted juice squeezed out. The juice expressed from each mill is pumped by unchokeable pumps and sprayed on to the cane blanket as it emerges from the previous mill in the line. The fibre absorbs this moisture and during the ensuing milling the re-expressed liquid removes further sucrose from the cane.

After the last mill but one, imbibition water is applied. All the water added has to be evaporated subsequently and so only that quantity of water is used which is needed to give a good extraction of sucrose from the cane.

Prime movers for mills

The mills are driven through reduction gearing by different types of prime movers. Horizontal steam engines of the piston-valve, drop-valve or Corliss type have been used in the past, running at 40 to 60 r.p.m. and driving from one to five mills per engine. High-speed vertical steam engine and electric motor drives have been used to a lesser degree and in recent years the turbine has been adopted extensively.

The turbine has the advantage of having greater flexibility than reciprocating engines and can be designed for greater variations in steam conditions and throughput of the mills. It is, for instance, possible to provide an increase in both speed and power of about 100%, thereby permitting throughputs to be doubled at such a time as development of the cane lands and cane supply permits. The turbine also compares favourably with other prime movers in first cost and maintenance costs, and the exhaust steam, being uncontaminated with lubricating oil, is more suitable for use in heating and evaporating vessels.

In most modern cane factories there is a surplus of fuel for the boilers and here the single-stage turbine is usually employed, but if surplus bagasse can be utilised for the manufacture of by-products such as paper, corrugated board, furfurol, etc., then the multi-stage turbine is more attractive owing to its more economical steam requirements which then offset its greater initial cost.

Gearing between prime mover and mill used to consist of the open-spur type with machine-moulded teeth, but most modern engine-driven tandems have machine-cut teeth for the first motion gears. Turbines are supplied to run at between 4,000 and 7,000 r.p.m. and speed reduction is achieved by a double reduction box followed by enclosed double reduction, double helical gears or double reduction spur gearing, all having machine-cut teeth.

Steam generation

Water-tube boilers are used extensively for the generation of steam. In modern factories, steam is generated at 250 to 350 p.s.i.g. with 100° to 150° S.H. There is no particular advantage in generating at high pressure, because a large percentage of the steam is required for process at 5 p.s.i.g. and the high-pressure boilers require greater skill in operation and maintenance than is normally available in a raw-sugar factory.

Treatment of mixed juice

The mixed juice from the first two mills is screened by a simple drag-type scraper running over perforated brass sheet or on vibrating screens, and the 'cush cush' or small cane fibres are returned to the mill tandem while the screened juice is pumped to a liquid scale for weighing. These scales work on the simple out-of-balance principle and are used for metering mixed juice, maceration water and the final molasses. The latter is a by-product at the end of the process used for distillation into rum, alcohol, etc., The scale is robust in construction and accurate in operation and requires the minimum of maintenance. It is automatic in action and simple in design.

Clarification

The next problem is to clarify the mixed juice, which is turbid and greyish in colour, so that it can be crystallised into sugar, and this is achieved in a normal raw-sugar factory by the addition of lime and heat. Milk of lime of 15° Beaumé is added in two stages to change the acidity of the juice from 5 *p*H to an alkalinity of about 8 *p*H. The *p*H of the limed juice is controlled and recorded automatically as it leaves the second liming tank.

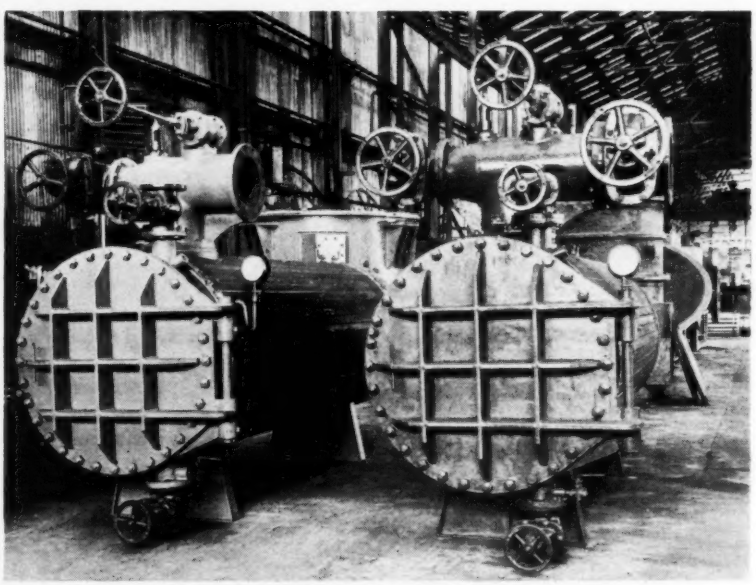


Fig. 2. Two 800-sq.ft. horizontal juice heaters.

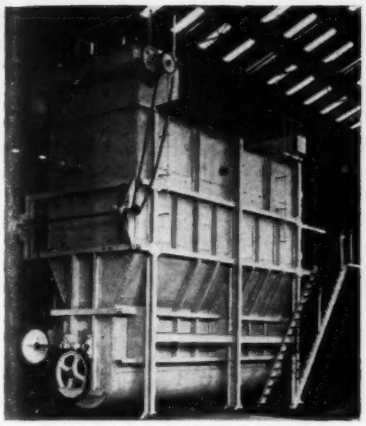


Fig. 3 (*above*). **View of a sugar-juice clarifier from the driving end.**

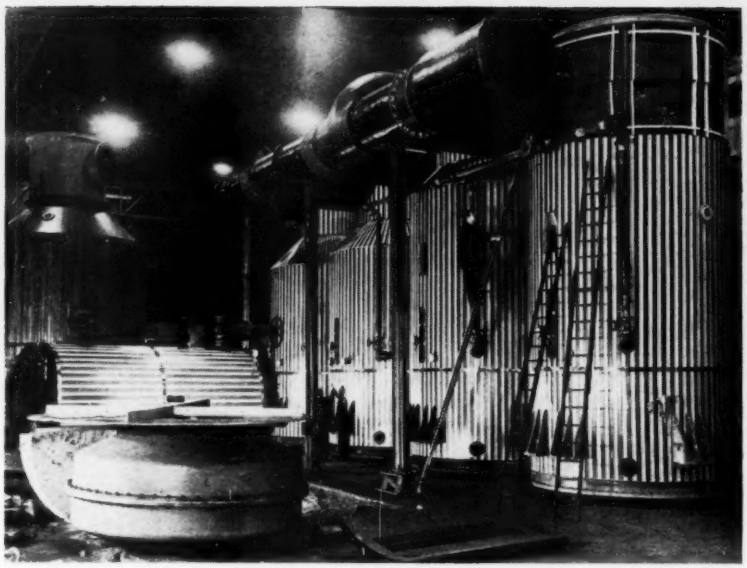


Fig. 4 (*right*). **In course of assembly is an 18,000-sq.ft. evaporator for South Africa, with 2,000-sq.ft. juice heaters.**

The limed juice is next heated in two stages to raise the temperature from 80 to 170°F. in the first stage and from 160 to 220°F. in the second stage. Heat exchangers of the horizontal or vertical type are used consisting of welded steel body and tube plates and brass or copper tubes of from $\frac{3}{4}$ to $1\frac{1}{4}$ in. o.d. Two horizontal juice heaters are illustrated in Fig. 2.

The chemicals used in the clarification process vary from country to country, according to the difficulty of producing a clear juice or the type of sugar required. For a raw sugar of 96° pol., lime and heat are usually the only clarifying agents, but phosphate is also added in some countries where clarification is difficult. Some countries such as India and Pakistan make a plantation white sugar for direct local consumption and sulphur and/or limestone are required for use with the double sulphitation or double carbonation clarification process now in use.

After the addition of chemicals and heat, the mixed juice enters a clarifier at approximately 220°F. through a juice separation compartment to allow excess heat to flash off as vapour. A clarifier may take the form of a box or of a vertical cylinder, but in either case it consists of several compartments where the flocs caused by the action of heat and chemicals on the impurities in solution gradually subside downwards entraining suspended solid impurities as they sink. Fig. 3 shows a Fortier clarifier.

Processing of clarified juice

Clear juice flows from the top of each compartment by gravity through a weir type of valve which enables the discharge of juice from any particular compartment to be restricted if it is not sufficiently clear. The settled muds may be thickened by a slowly rotating element or scrapers and then removed by diaphragm pumps. Fine particles of bagacillo, which have been screened from the bagasse on its way to the boilers, are added to the muds to act as a filter aid and the mixture is picked up on a rotary vacuum screen through which the clear juice is drawn. Washing the muds on the screen reduces their sucrose content to between 0.2 and 1%. The muds are discarded for use as a fertiliser.

The clear and cloudy filtrates are often treated with lime and heat and the impurities settled in a separate clarifier before the filtrate is sent to the evaporator supply tank. Recently, successful experiments have been carried out by passing the filtrates to a flotation clarifier without the use of additional chemicals. Here air is entrained in the liquid and, during subsequent heating within the clarifier, impurities rise to the surface and are removed by slow-moving blades.

The clarified juice is then concentrated from about 14 to 60° Brix in a multiple-effect evaporator. A quadruple-effect evaporator can be seen in Fig. 4. In the sugar industry three, four or five vessels are used and they are of mild-steel or cast-iron construction, the latter sometimes being preferred where sulphur is used in the clarification process. In order to save steam, it is common practice to design the first vessel with a bigger heating surface than the remainder and to bleed off part of the vapour produced in this vessel for use in juice heaters and vacuum pans, this steam thus being used in double effect.

Back-pressure steam from the prime movers driving the mills and from the turbo-alternators is fed to the first vessel at a pressure of 10 to 15 p.s.i.g., but if no vapour bleeding is required then a pressure of 5 p.s.i.g. is satisfactory. Live steam make-up valves are installed in the back-pressure main to the evaporator and in the first vapour main to provide a heating medium of constant temperature which is so essential for good process work.

Constructional features of evaporator calandrias

The vessel calandrias are usually fabricated with steel tube plates and wrapper plates and have either copper, brass or steel tubes ranging from $1\frac{1}{4}$ to $1\frac{3}{4}$ in. o.d. in the first vessel and $1\frac{3}{4}$ to 2 in. o.d. in the remaining vessels. The centre-well downtake has been used extensively in the past, but of recent years an evaporation rate of 8 to 8.5 lb./sq.ft./hr. of heating surface has been achieved with a semi-climbing film design which incorporates a sealed downtake. Unlike the original type where the juice circulates many times within each vessel, the new design is of the single-pass type and the level of the liquid in any one vessel automatically reaches equilibrium with the levels in other vessels without the use of external controls between units.

Provision is made for the removal of incondensible and noxious gases from the calandrias, for the extraction of

condensate and for the extraction of syrup from the body of the last vessel, which is operating at a vacuum of 26 to 27 in. of water.

Crystallisation

The syrup is pumped to the pan floor, where it is crystallised in vacuum pans. A three-boiling system is commonly used to produce three types of sugar, graded according to sucrose purity. A footing of magma, consisting of crystals mixed with syrup, is first drawn into the pan or, alternatively, a footing of syrup is taken in and concentrated to the point of supersaturation where crystallisation occurs. Syrup is then fed to the pan and the crystals increase in size until the pan is filled with 'massecuite,' a mixture of crystals and mother liquor. This is fed to centrifugal baskets where the sugar and molasses are separated. The molasses is returned to be boiled on to a fresh footing to get a second-grade sugar, and the whole process is repeated yet a third time. This results in three grades of crystals, of which the first two are mixed together to give a raw sugar of about 96° polarisation, and the third sugar is mixed with syrup to provide the magma required as footings for the first two boilings.

Vacuum pans are single-effect vessels and may be of two types—calandria or coil—according to the type of heating medium provided. A pan is constructed of either mild steel or cast iron and consists of a bottom, calandria (or coils), belt, conetop and headbox. The calandria has a large circulation tube in the centre, probably of a diameter equal to half that of the vessel in order to promote circulation. Tubes may be of copper, brass or steel and are usually 4 in. o.d. A calandria pan is illustrated in Fig. 5.

Alternatively a number of banks of coils may be provided from the bottom of the vessel to just below the level of the massecuite when the pan is full. Coils are usually of copper and may be of flattened section to give the maximum of heating surface with the minimum interference with circulation.

The pan is operated manually for a short time at the beginning and end of each 'strike,' because human experience and judgment is required, but for the remainder of the time, modern practice is to use instrument control for feeding the vessel with syrup or molasses. In order to get steady growth of the existing crystals without the formation of new crystals the supersaturation of the massecuite must be kept constant. Changes in massecuite density correspond to changes in supersaturation and so density measurement is used to control the feed to the pan, allowing an increased feed when supersaturation increases and *vice versa*.

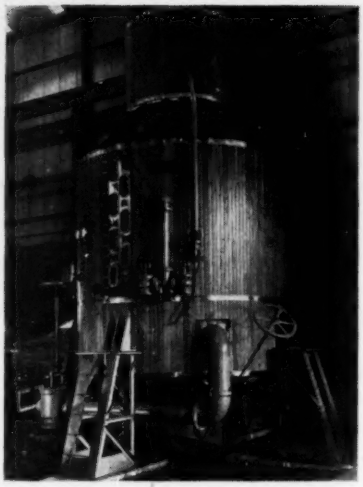


Fig. 5. An 11-ft.-diam. centre-flow vacuum pan destined for British Guiana.

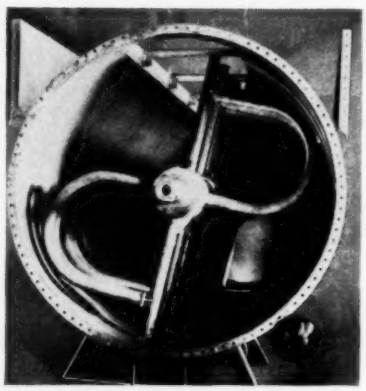


Fig. 6. The Fletcher-Blanchard-type crystalliser cooling element.

The low-grade massecuite from the third boiling is discharged to a crystalliser, which is a horizontal heat exchanger in which a cooling element rotates. (An end view is illustrated in Fig. 6.) As the massecuite slowly cools from about 70°C. to about 40°C. over a period of 18 to 36 hr., sucrose in solution in the molasses is deposited on the existing sugar crystals. With this temperature drop, viscosity increases and it is usual to reheat the massecuite at the end of the cycle to facilitate pumping and purging in the centrifugal baskets, care being taken to avoid remelting the crystals.

Centrifuging

Massecuites from all boilings are fed to vertical, high-velocity centrifugal machines which are either water-driven or have an independent electric motor drive. The massecuites enter a cylindrical perforated metal basket, which is lined with wirecloth and perforated sheets, and the sugar crystals are retained while the molasses is spun off by centrifugal force. The machine is stopped and the sugar crystals are cut down. They are conveyed to a bagging plant if of the first two grades and to a magma mixer for mingling with syrup if of the third grade.

The majority of centrifugal machines in use work on a batch basis and are partially or completely automatic. Continuous machines are being developed, but have not yet been accepted by the industry.

Molasses from the first and second massecuites is returned to the pan floor for reboiling and the low-grade or blackstrap molasses is pumped to a scale for weighing and then to storage tanks.

If a raw sugar is being produced, as described above, the first- and second-grade sugars are mixed together and fed to hoppers where they are weighed and bagged on standard machines. Plantation white sugars, which are produced by more elaborate methods of clarification than those described above, may pass through a horizontal drier and be screened prior to bagging.

Future outlook for the industry

Two problems which will have to be faced by the industry in the immediate future are, firstly, the difficulty in finding sufficient labour to harvest the cane by hand. This will lead to the extension of mechanical harvesting as now practised in Australia, Louisiana and Hawaii. It is only in Hawaii that the harvesting takes the form of grabbing out of the ground the whole plant with roots and here it is necessary to provide additional plant for removing stones, soil, etc., by cane flotation methods. The additional fine soil particles in the cane blanket make the clarification of the juice more difficult and the installation of more plant may be required.

Secondly, as the standard of living rises in the cane-growing countries of the world, there will be an incentive to cut down the labour force. Instrumentation and automatic controls will assist in this process and will also bring advantages in diminishing the risk of human error.

FILTRATION

By H. K. Suttle, A.M.I.Chem.E., F.R.I.C., M.Inst.F.
(Department of Chemical Engineering, Loughborough College of Technology)

Theoretical and practical advances; atmospheric pollution problems; filter media; filters in unit processes, etc.

As in previous years, this account will cover normal methods for the separation of solids, although some reference will be made to the associated process of centrifuging. The removal of airborne dusts and aerosols will be again considered, as appropriate.

A transitory perusal of the literature of chemical engineering during the past year will reveal a growing fulfilment of the demand for textbooks and reference books. Three new textbooks[1, 2, 3] on unit operations have appeared, in all of which the subject of filtration is considered. Similarly, there may be observed a revival of interest in fundamental studies.

Theoretical advances

F. Sjenitzer[4] has emphasised the parabolic nature of the filtration curve obtained in a constant-pressure batch process, thus confirming again the observations of investigators in the past—notably the contribution of D. R. Sperry.[5] An equation is derived which, it is claimed, is suitable for both compressible and non-compressible cakes, and which constitutes the basis for calculations in continuous rotary filtration. The written discussions on this paper are stimulating contributions by eminent authorities, and the 19 references constitute a useful bibliography.

Thirty-three references accompany the interesting paper by A. F. Orlicek,[6] which discusses the physical principles on which the theory of filtration is based. As in the case of the paper by Sjenitzer, the author commences by reference to d'Arcy's law—now almost a century old—and proceeds to build a series of equations based on Poiseuille's law. In addition to a consideration of the nature of the influence of compressibility in filter cakes, electrokinetic effects and the resistance offered at the boundary of the filter medium and the cake are also discussed. Suggestions are then made for the prediction of operation under industrial conditions. The rate equation takes into account the specific resistance of the cake and also the permeability of the filter itself.

Kottwitz,[7] of Iowa State College, has published an account dealing with the prediction of filtration resistance by compression and permeability techniques. Under the title, 'Some Aspects of Filtration,' Volckman[8] has presented an account which deals theoretically with a variety of phenomena which influence the filtration process.

Practical studies

In contrast to the academic, or speculative, approach to the problems of filtration, articles of a practical nature have appeared intended to serve as guides in the choice of plant or to emphasise a distinct process. The paper by Nickolaus and Dahlstrom, reviewed in January 1956,[9] dealing with continuous-pressure filtration, has now been published.[10] A series of seven articles has been presented by B. H. Refson,[11–17] the most interesting of which are those describing filter media. These range from the usual materials and weaves[12] to constructions of sintered materials from metals, plastics, glass and ceramics.[14] The final contribution describes several modern types of plant, chiefly large-capacity continuous units.

A CPE chemical engineering review

A wider, and more general, field is covered by C. J. Pratt,[18, 19] who draws attention particularly to the choice of machine in relation to the operation to be performed. Thus the discussion progresses from gravity filters to pressure, and centrifugal plant. The article by Trowbridge,[20] consisting of an account of modern centrifugal filters, may be included here. 'Solids-Liquid Separation' is the title given to a series of seven articles by various authors.[21] For the purpose of this review, attention might be directed especially to the contribution of J. C. Smith, dealing with rational methods of approach to the choice of equipment, and also to the article by Chalmers, Elledge and Porter, which describes filter units in considerable detail. The latter contribution commences with an outline of filtration theory and continues with an excellent account of modern filter units. Suggestions for control of the process and the nature of ancillary equipment are also presented. The preparation and control of the slurry to be treated is emphasised throughout the series of articles.

Air pollution and allied subjects

Atmospheric pollution was the subject of a symposium held in London during April 1955.[22] In addition to filter plant, several different units are, of course, employed in attempts to deal with this problem. McCabe[23] has described methods adopted in attempts to recover the fine alumina dust which is discharged in the electrolytic reduction of alumina.

A survey of considerable value, to both the student and the practising engineer, on the removal of aerosols has been presented by I. T. Smith.[24, 25] The first part deals with the uses and expected efficiencies of cyclone separators and electrostatic precipitators, while the second considers the collection of particulate matter by means of a device employing impact. The author explains that the most difficult size to remove efficiently by means of a filter is 0.5μ to 0.1μ, and electrostatic phenomena may add to other operating difficulties. Particle-size limits are stated for other devices.

Refson[12] refers particularly to the formation of electrostatic charges on synthetic filter weaves, and it is interesting to speculate on the part played by this phenomenon where a filtration process is employed for carbon black.[26] D. L. Allan, in his contribution,[26] reminds us that 'the settling rate in air of a spherical

particle, 1,000 mμ in diameter (*i.e.* three times that of the coarsest carbon black) and a specific gravity of 2, is only 1.8 ft./hr.'[27] In the carbon black process, the hot gases from the furnaces are quenched to a temperature of about 500°F., and carry some 14.7 gr. of carbon/cu.ft., measured at this temperature. The carbon is very finely divided at this stage and is agglomerated by passing through electrostatic precipitators. After a series of cyclones, the recovery may be now as high as 95%. The remaining 5% has been recovered by wet electrostatic precipitation, a process which gives rise to a very corrosive liquor. The corrosive conditions which occur when the gas temperature is lowered below its dewpoint has meant that very careful consideration must be given to the constructional material when bag filters are to be used for this particulate carbon. Even with *Orlon*, corrosion is a severe problem, as the gas must first be cooled to a temperature lower than 250°F. It is stated that woven glass fabric may be used as a filter for temperatures exceeding 400°F. The formation of slurry does not occur at this temperature and corrosion is greatly reduced. Mention is made of filter bags made of silicone-treated glass fabrics and also from polytetrafluoroethylene fibre.

Burke[28] discusses the question of the prevention of dust emission in the cement industry and clearly shows the immensity of the problem. He states that the type of dust likely to be dispersed consists of 97% finer than 60μ and 50% finer than 10μ. An interesting section of this paper deals with the quantitative determination of dust in an atmosphere.

Stairmand and Kelsey[29] show how cyclone design should be varied for several applications, and Jackson and Solbett[30] discuss the problems associated with the effluent gases from sulphuric acid plant.

Gas cleaning

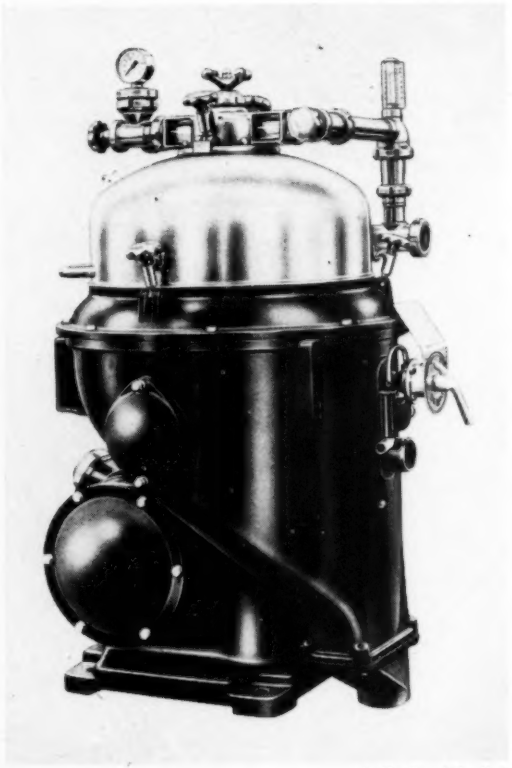
Stairmand has presented a most comprehensive paper on gas-cleaning equipment to the Institute of Fuel.[31] Fibre and fabric filters are described, together with other forms of cleaning apparatus. The individual textile fibres from which a typical filter cloth is made may be only some 5μ to 10μ in diameter, and in the normal weave these fine, hair-like fibres constitute impingement targets between the warp and weft, which are so effective that particles as small as 1μ to 2μ may be removed. After the preliminary build-up of a floc-like filter bed, efficiencies approaching 100% in a multi-unit apparatus may be expected. Emphasis is laid on the operating velocity at which gas passes through the fabric. It is stated that a satisfactory speed range is 1 to 6 ft./min. A table showing approximate costs for a variety of dedusting systems concludes the paper. Two appendices deal with a method for the calculation of the performance of a dedusting unit, and also with sampling procedure.

Filter media

The search for an ideal filter medium is graphically illustrated by two papers which have been published during the past year. The filtration of particles from gases which are at temperatures up to 1,500°F. forms the subject of a valuable paper by W. W. First *et al.*[32] A filtration efficiency of 99% was required for gas at 1,400°F. (760°C.) and for this purpose filters constructed of ceramic fibres (4, 8 and 20μ in diameter) were used. The experimental procedures employed are described.

A very interesting account has been published from the U.S. Naval Research Laboratory, under the authorship of Wente and Lucas.[33] It was in 1950 that glass filaments (2μ in diameter) were used to produce a 'paper' by means of a commercial-type paper machine. It was then found that, if the fibre diameter was of the order of 1μ, a paper of ample strength could be produced. A special field of use for such material was in the removal of aerosols by filtration, and this article is concerned with the properties and methods of testing such a filter medium. The volume-surface average fibre diameter, calculated by a method suggested by Dallavalle[34] is used for comparison of the filters and the prediction of filtration performance. Several interesting phenomena observed in the manufacture of the 'paper' are described.

An article edited by D. R. Cannon[35] is an advertising feature containing useful technical and design matter relating to the new resin-bonded, tough, felted material constructed of staple synthetic fibres. These preparations possess high strengths, den-



[*Alfa-Laval Co. Ltd.*

The new De Laval PX clarifier, fitted with a stainless-steel bowl from which sludge is discharged automatically while the bowl is running at full speed. The clarified liquor is discharged under pressure in a non-aerated condition. This machine is particularly suited for the clarification of beer wort, fruit juices, oils and fats, etc.

sities varying from 30 to 45 (nylon) to 51 to 58 (*Dacron*) lb./cu.ft., and corresponding porosities of 59 to 72 and 43 to 64%, respectively. The use of man-made fibres for the construction of filter media is discussed in a chemical engineering review by Grove, Casey and Vodonik.[36]

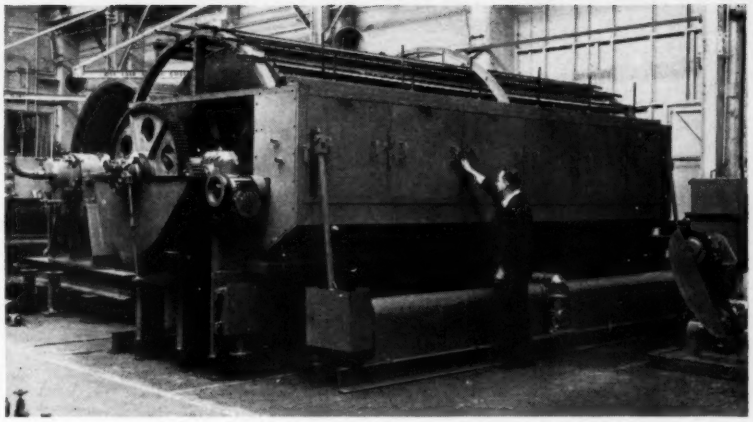
Filters in industrial processes

Filtration is so very essential in most unit processes that it is not surprising to discover reference to it in many fields of activity. In the growing field of biochemical processes, filtration is of the utmost importance, as shown in two papers during the period under review. Under the title, 'Fermentation,' an article[37] points out that trickling filters are considered to be the more satisfactory units for the treatment of liquid wastes from the manufacture of antibiotics, vitamins and sulpha drugs, rather than anaerobic digestion or filtration and incineration.

A comprehensive article dealing with biochemical processes used in the treatment of trades' wastes[38] includes an excellent account of the operation and the results obtained with trickling filters. It may be observed that the biochemical oxygen demand may be reduced as much as 94% under summer conditions when using a filter depth of 6 ft.

The writer is again indebted to Prof. D. A. Dahlstrom for information on valuable contributions to research. That by Schepman and Cornell[39] is concerned with the evolution of a technique of filtration analysis, by means of a test leaf, for sewage-sludge filter station design and the determination of the optimum operating conditions. The test leaf employed has a filtering area of 0.1 sq. ft. and was used for laboratory studies, but a pilot plant including a 4 ft. diam. × 2 ft. face Eimco *Rotobelt* filter was used for large tests. Polythene cloth was selected as the filter medium and the sludge was flocculated by the addition of ferric chloride and lime.

In May 1955, Dahlstrom and coworkers presented a paper on fundamental variables which affect the filtration of corn gluten,[40] which has since been published under the heading of rotary filtration of this material.[41] A statistical approach is made to the analysis of the test results and an economic evaluation of the proposed plant is given. The problem is, of course, particularly difficult and has hitherto been resolved by plate and frame units, which have been shown to be both time consuming and costly.



[*Davey, Paxman & Co. Ltd.*

This filter, with a 400-sq. ft. filtering area, was specially designed and constructed to meet the requirements of the sugar cane industry and is being installed in a factory in India. The unit is of the shallow vacuum cell design with internal pipes and special perforated sheets secured to the periphery of the drum. Special wash gear of an improved type is fitted and will serve to extract residual sugar from the mud. When installed, the complete unit will comprise the filter, vacuum pump, two receiver tanks, two filtrate extraction pumps, a surface condenser and vacuum seal tank as for a standard installation, but in addition a special shaking screen will be supplied to separate the *Bagacillo* (crushed sugar cane) dust from the larger solids, an exhaust fan to convey the *Bagacillo* dust to the cyclone separator, and a feed mixer to mix the dust from the cyclone with the sugar cane muds taken from the bottom of the clarifier.

In the continuous process, however, quite thin gluten cakes only are possible, of the order of $\frac{1}{8}$ in., and this difficulty is overcome by the use of discharge strings. In this manner, blinding of the cloth is avoided and, it is stated, the cloth life is much longer than for plate- and frame-type filters. The uniform moisture content of the cake, although higher, should be preferable to the varying moisture content which is probable with a press-type filter.

A similar problem, in which a perfectly clean filtrate was required, has been solved at the works of Marmite Ltd. by the use of *Colite* 512 as the precoat material on rotary filters.[42]

In heavy industry, the beneficiation of iron ores to a concentration suitable for blast-furnace operation also includes the operation of filtration. This is graphically described in an interesting paper presented by Dahlstrom *et al.*[43] It is concerned with the filtration of the slurry concentrate obtained in the processing of magnetic taconites. The final concentrate contains 55 to 70% solids by weight, the particle size of which is at least 60% less than 325 mesh. In such operations, a very high rate of filtration is essential and, moreover, the moisture content of the filter cake obtained must be such as will allow of satisfactory 'balling' in the next operation. The *Agidisc* filter was used and filtration rates of from 250 to 600 dry lb./hr./sq.ft. were obtained.

Chemical plant applications

The increasing tendency to arrange continuous, or semi-continuous, filtering machines is to be observed in new plant recently described. Bender[44] has reviewed this aspect of design so far as Continental machines are concerned and, in particular, illustrates sintered materials as filtering media. Centrifuges are also considered. An advertising feature gives an illustration[45] of a leaf filter which employs high-pressure liquid jets to remove the cake by sluicing. A self-cleaning leaf filter made by the U.S. Filters Co. is similar in arrangement and has been described.[46] A patent specification[47] also relates to the removal of filter residues from plates.

A vacuum liquid filter[48] process is claimed in which the liquid to be filtered is fed into a trough with an inclined base and the elements constituting the filter move successively into and out of the liquid. The solids are removed by suction from the liquor and discharge is achieved, when the elements are out of the liquid, by blowing.

A pressure-tank filter for clarifying water has been described.[49] Water flows upward through filter leaves suspended within a closed tank, and rates up to 1.5 U.S. gal./min./sq.ft. have been obtained. Cleaning is

achieved by back washing at the conclusion of the filtering cycle.

Filtration by sound waves

A most interesting account has been presented to the chemical engineering group of the Société de Chimie Industrielle by P. Korda,[50] dealing with the use of sound waves in dispersing, sieving and filtration. Electro-magnetic devices are described which produce vibrations at the rate of 50 c/s., when using single-phase current, and are transformed mechanically to 100 c/s. This rate of 100 cycles is commonly used. In the section dealing with filtration, it is noted that the first prototype was described to Achema in April 1955, and since this time it has been the subject of theoretical studies. In effect it may be said that filtration has been achieved by means of sound waves! The fluid, liquid or gas, which has suspended matter in it is brought into contact with a vibrating metallic screen provided with openings, size 60μ. A harmonic vibration of 1,200 c/s. is given to the screen and it is observed that all particles up to a size of 5μ are arrested at a point about 1 mm. from the screen by what can be described as a wall of sound waves. The liquid proceeds through the screen and the solids are recovered as a thick mud from the conical base of the apparatus.

Another intriguing unit is described in a patent specification relating to the separation of magnetic particles suspended in a liquid.[51] Vacuum filtration is employed in conjunction with a magnetic field, using a rotating cylinder. The particles are retained on a filter medium placed on the cylinder. During the period January to August 1956, some 27 patents relating to normal filtration procedures have been noted. In addition to the ingenuity displayed by inventors, manufacturers have shown equal activity in providing better materials. Of interest in this regard are the epoxy-resin drain cocks developed for filter presses,[52] and the use of *Monel* as a material of construction in the filtration of sugar juice.[45] The great variety of materials which can be used in filtering plant is certainly impressive.[53]

An article which may be of interest to filtration engineers is one on the cost of installing centrifugal pumps, contributed by Lundeen and Clark,[54] and a book which must prove useful in this field has been published by Gurnham[55] on the treatment of industrial wastes. In conclusion the extensive review contribution by S. A. Miller[56] must be brought to the notice of the reader. The references are chiefly related to work published in 1955. Prof. Miller contributed to the discussion on the paper by Sjenitzer,[4] presented to the Institution of Chemical Engineers.

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SYMPOSIUM ON CHEMICAL ENGINEERING EDUCATION

The Institution of Chemical Engineers will be holding a symposium on 'Chemical Engineering Education,' at Birmingham University from April 9 to 11 this year. The symposium will be divided into four main sessions and various aspects of education will be discussed under the general headings: 'The Requirements of Industry,' 'Methods of Training,' 'New Trends in Teaching Chemical Engineering' and 'Recruitment to the Profession.'

The speakers will include distinguished speakers from industry and educational establishments, including the heads of university chemical engineering departments.

Registration forms are available from the Symposium Manager, Chemical Engineering Department, The University, Edgbaston, Birmingham 15.

Progress in Europe's Chemical Industry

PRODUCTION STATISTICS REVEALED IN O.E.E.C. REPORT

Chemical production in the O.E.E.C. countries increased by 11.5% *in* 1955 *as compared with* 1954. *The first six months of* 1956 *showed an increase of* 6% *over the corresponding period of* 1955. *These conclusions are reached in a report of the Chemical Products Committee of the O.E.E.C., prepared in October* 1956 *and recently published.* It includes an analysis of the situation in Europe in* 1955 *and the first six months of* 1956, *together with numerous statistics and some information on chemical production in the United States. This article summarises some parts of the report, dealing mainly with the heavy chemicals and allied sectors.*

THE steady upward trend shown by the chemical industry since the war, except in 1952, continued in 1955. Production was 11.5% higher than 1954. However, the rate of increase was somewhat slower than in the two previous years when it was about 14% and 15% respectively.

Since 1950, expansion in the chemical industry has been higher than in industry as a whole, the gap widening in 1953 and 1954. In 1955, the rate of increase of industrial production was 8.6%, so that the difference between the rates of expansion was somewhat smaller.

Chemical production continued to increase during the first six months of 1956, rising by 6% over the same period of 1955. It seems that, like total industrial production, the rate at which chemical production is expanding is slowing down at least temporarily. Industrial output rose by 5% in the first half of 1956, compared with the same period of 1955. The gap between the two indices thus continues to narrow.

In the United States, chemical production rose by 13% after a year of levelling off, during which the index of industrial production fell by 8 points. Apart from this, the same phenomenon as in Europe was witnessed, although to a lesser extent: *i.e.* the index of chemical production has been higher than the index of industrial production ever since 1950.

Use of production capacity

Generally speaking, capacity continued to be well taken up in 1955 and the increase in chemical production was primarily made possible by the modernisation and extension of existing plant and the opening of new factories. In the petroleum chemical field a substantial increase in production was largely the result of increased output from existing plants.

But the report states that, in other sectors, particularly where there are structural difficulties, the situation has scarcely improved. In the dyestuffs industry, it is probable that the surplus capacity is partly due to the economic situation and partly structural. In the first case, modern high-quality dyestuffs suffered as a result of a slight decline in activity in the textiles industry. It may therefore be hoped that, with the recovery in this industry early in 1956 and growing demand by other user industries, the surplus capacity will be absorbed. With regard to ordinary dyestuffs, the export market situation does not seem to indicate any change in the demand for these products.

In the fertiliser sector, the situation in the superphosphates industry has not changed and seems scarcely likely to do so in the foreseeable future, owing to the very slow increase in the consumption of phosphatic fertilisers and the competition of other types of phosphate fertiliser, in particular basic slag.

Although the use of capacity is normal in the United Kingdom and Italy, it is only 50% in Germany, France and the Netherlands and 30% in Belgium. Competition from basic slag is particularly felt in these latter countries.

In the soap industry, competition from synthetic products caused production of household soaps to decline and the surplus capacity of the industry as a whole is now estimated at 50% of the total. Since this tendency towards the greater use of substitutes will probably persist, the situation is likely to deteriorate, and this trend should be considered as a structural change in the industry.

Labour force

In 1955, the labour force employed in the chemicals industry was 5% greater than in the previous year. Out of a total of about 1,350,000 persons, 400,000 were managerial, technical and clerical staff and 950,000 operatives.

Among the matters of special concern to the Chemical Products Committee referred to in the report, particular mention is made of the shortage of skilled labour and of highly qualified scientific and technical staff. Whereas most countries already seem to have taken steps to improve the situation as regards the first point, the second remains the more disturbing, as it is likely to influence not only the present course of the European chemical industry and its competitive position on the world markets but also its future.

Market trends

Between a quarter and a fifth of chemical production is, on the average, consumed by the chemical industry itself; most of the rest is sold to a wide range of other industries and to agriculture; a relatively small proportion of the total (*e.g.* soaps, paints and pharmaceuticals) is destined for direct consumption.

The level of chemical production is therefore determined mainly by the level of activity throughout industry, together with the rate of development of new products. Both these factors combined to make the level of activity of the European chemical industry high in 1955. With the exception of the textile industry (where demand

* 'The Chemical Industry in Europe,' Organisation for European Economic Co-operation, Paris. Pp. 211, 14s.

was practically steady or slightly down) and the leather industry (where varying trends were observed), demand from all other manufacturing industries seems to have been expanding. In agriculture, the demand for fertilisers continued to rise slightly and for the other chemicals used in agriculture (fungicides, insecticides, etc.) the increase in demand was even higher.

In general the chemical industry was able to meet demand. In some cases such as carbon black, anti-knock products and certain types of plastics materials in particular, imports from the United States increased considerably. This has led European countries to increase production capacity in certain cases to meet growing demand (*e.g.* certain plastics materials and detergent raw materials). It is this rapid development of new products that is mainly responsible for the fact that the chemical industry is expanding more rapidly than manufacturing industry in general.

This increase in chemical production naturally brought with it an increased demand for chemicals on the part of the industry itself. The biggest increase was in demand for organic chemicals (*e.g.* plasticisers and solvents); the rapidly expanding output of the petroleum chemical industry played a major part in meeting this demand.

In the inorganic field the main increases in demand were for chlorine and phosphorus. Chlorine is used in the manufacture of chlorinated hydrocarbons (solvents, plastics materials, insecticides and weedkillers, etc.) and closely follows the expansion of production in these sectors. The largest single use of phosphorus is in the manufacture of ingredients for synthetic detergents, a greatly expanding field. It is also used extensively for anti-knock products.

Price trends

Despite an increase in wages and in the prices of certain raw materials in most O.E.E.C. countries, the price index of chemicals remains generally steady, although it showed a slight tendency to rise in some countries. Export prices tended to fall as the result of very keen competition on world markets. These trends continued in the first six months of 1956. The report points out that the price index for chemicals is still generally well below the index of industrial prices. The reason given is that, owing to high productivity and constant improvements in the organisation and equipment of firms, the industry has so far absorbed increases in the costs of raw materials and labour without risk to its profit-earning capacity or its future.

Basic inorganic chemicals

In this branch of the chemical industry, for which six representative products were selected, production continued to increase, but more slowly than in 1954. The rate of increase varied between about 4% for caustic soda and calcium carbide and 12% for chlorine. Apart from this last, for which new uses have developed in the rapidly expanding organic chemical industry, the products in question generally have long-established outlets and follow closely the trend of the major user industries.

Soda ash. Six member countries, producing 55 to 60% of total O.E.E.C. output, manufactured 2,251,600 tons of soda ash in 1954 and 2,382,900 tons in 1955, an increase of nearly 6%.

The rate of increase in the United States was lower (only 4%), output rising from 4,269,000 tons in 1954 to 4,455,500 tons in 1955. Even so, the United States' production index for soda ash based on 1950 is at a higher level than that of member countries.

Caustic soda. The output in nine of the thirteen O.E.E.C. producers, which together account for about 55% of member countries' total production, was 1,273,000 tons in 1955, an increase of about 4.5% over the previous year.

In the United Kingdom, which is a large producer of caustic soda, production increased by 3.5% in 1955 compared with 1954. Thus output of O.E.E.C. countries combined probably rose by about 4%.

The United States' output rose much more substantially from 3,081,600 tons in 1954 to 3,545,000 tons in 1955, an increase of 15%.

Chlorine. No figures are available for Austria, the Netherlands, Switzerland and Turkey. The United Kingdom index shows that output in that country rose by 8% in 1955 over 1954.

The other nine countries producing chlorine made 727,400 tons in 1954 and 833,700 tons in 1955, an increase of 15%. It is thus probable that total output rose by about 12% in 1955 compared with 1954, a percentage considerably lower than the corresponding figure for the United States. The United States' output is approximately double total O.E.E.C. production, and rose from 2,629,000 tons in 1954 to 3,094,000 tons in 1955, *i.e.* by 18%.

Chlorine is the only one of the six inorganic chemicals under consideration where output has in general risen, both rapidly and continuously, over the last five years. Unlike the other inorganic chemicals under review, it is used above all as a raw material for the organic chemical industry in the manufacture of such chemicals as ethylene and propylene oxide and glycol, chlorinated benzene, trichloroethylene, carbon tetrachloride, polyvinyl chloride, etc. Demand for chlorine has thus followed the expansion of the organic chemical industry closely. Despite production in the United States being double O.E.E.C. countries' output, the rate of increase is higher there than in Europe. It thus looks as if there were still scope for expansion in O.E.E.C. countries' demand for chlorine for several years to come.

Sulphuric acid. Output has risen over the last five years much more quickly in O.E.E.C. countries than in the United States, though the increase in output in 1955 over 1954 was approximately the same.

The largest increases in output in 1955 compared with 1954 were in Austria, Switzerland, Greece and the Belgo-Luxembourg Economic Union.

The fertiliser industry is by far the most important consumer of sulphuric acid, taking 55% of total output in 1955. It is mainly used for production of superphosphates and ammonium sulphate and, while production of the latter has risen regularly over the last few years, superphosphate output has recently increased much more slowly (by about 4% p.a.).

Calcium carbide. The principal O.E.E.C. producers made 1,580,500 tons in 1954 and 1,639,100 tons in 1955, an increase of 4%.

O.E.E.C. output is roughly twice United States' production of calcium carbide, which rose by 23% to 794,460 tons in 1955 compared with 647,800 tons in 1954. The United States figure covers, however, commercial production only. Production in this country seems much more liable to fluctuation than in Europe and, despite the remarkable increase in 1955, output has risen at a slightly slower rate over the last five years than in O.E.E.C. countries.

Primary ammonia. O.E.E.C. countries' output has risen over the last five years much more slowly than United States' output. The increase was only 4% last year (2,670,000 tons of ammonia were manufactured in 1954 and 2,782,000 tons in 1955). Over the same period United States' output increased by 16% in line with rising fertiliser output; 2,469,000 tons of primary ammonia were manufactured there in 1954 and 2,872,000 tons in 1955.

Carbon black. Only three O.E.E.C. countries produce more than insignificant quantities of carbon black: Germany, Italy and the United Kingdom. Italian output covers a quarter of the country's requirements. One factory started production of various types of furnace black in 1955. The United Kingdom began to produce carbon black in 1949, and there are now three producers.

An idea of O.E.E.C. countries' requirements of carbon black can be obtained from the figures of United States' exports in 1955, this country being by far the most important supplier, exporting a total of 206,200 tons of carbon black in 1955, nearly a half of which went to O.E.E.C. countries.

Imports and exports. In 1955, inorganic chemicals accounted for about 18% of O.E.E.C. countries' total imports and 15% of their total exports of chemical products.

Trade in inorganic chemicals is generally rising, though the increase in 1955 compared with 1954 was lower than the increase in trade in 1954 over that of the previous year.

Of the important producers, two, France and Germany, increased their imports considerably in 1955 (by 35% and 44% respectively).

The exports of the main countries producing inorganic chemicals generally increased from 10 to 20% in 1955 compared with 1954, with the exception of Italian exports, which fell by 11% over the same period.

Basic organic chemicals

Organic chemicals accounted for 17% of total chemical imports by O.E.E.C. countries in 1955, and 13% of total chemical exports. The percentage for crude chemicals from coal was 2% and 1% respectively.

Organic chemicals are raw materials for many branches of the chemical industry such as plastics, pharmaceuticals, insecticides, solvents (for paints, varnishes and many other uses), etc. In general, these branches are developing rapidly and new products are constantly being put on the market. There is thus an ever-increasing demand for organic chemicals which has at times exceeded the rate of expansion of production capacity, as the rapid rise in imports in 1954 clearly showed. The 1955 trade figures seem, however, to indicate that the trade deficit last year is righting itself. Imports of crude chemicals from coal have fallen and imports of organics rose less in 1955 than in 1954.

In general, organic chemicals are manufactured in Europe by coal carbonisation, though the importance of petroleum as a basis for manufacture is rising. In the United Kingdom, as in the United States, about a third of organic chemical production is now petroleum based and the percentage will increase. The increasing importance of petroleum as a source for organic chemicals is obviously having an adverse influence on consumption of some traditional raw materials. Ethyl alcohol production from petroleum is already to a certain extent replacing output in Europe from molasses and sugar beet, and the production of ethylene directly from petroleum, and not from ethyl alcohol, means a reduction in potential demand for the latter.

The production of acetylene from oil or natural gas is expected to start shortly in Europe, and it may be that the increase in the demand for calcium carbide as a raw material for the manufacture of acetylene will lose momentum.

Miscellaneous sectors

Petroleum chemicals. This industry once again showed the most spectacular expansion, production in 1955 being one-third higher than in 1954.

Total investment in O.E.E.C. countries' petroleum chemical plants rose from $290 million at the end of 1954 to $314 million at the end of 1955. This was accounted for mainly by two new plants and an extension to an existing plant coming on stream in Germany. There was accordingly a sharp increase in production in Germany in 1955. In the rest of Europe, too, output from existing plants increased substantially at the same time so that the total carbon content of petroleum chemicals produced in O.E.E.C. countries, which had risen from 208,000 metric tons in 1953 to 305,000 metric tons in 1954, rose in 1955 to 397,000 metric tons.

Parallel with this increase in production has gone, of course, an increase in the feedstock consumed. This increase has been appreciable in the case of oil (from 692,000 metric tons in 1954 to 763,000 metric tons in 1955). But the biggest increase has taken place in the consumption of refinery gas (up from 349,000 metric tons in 1954 to 586,000 metric tons in 1955); consumption of natural gas has also risen from 66,000 metric tons in 1954 to 80,000 metric tons in 1955. It should, however, be borne in mind that the relationship between the quantities of feedstock used and the quantities of chemicals produced varies sharply, depending as it does on the nature of the feedstock, its processing and the chemicals produced.

Plastics materials. After a further increase of about 23% on 1954, sales of plastic materials by O.E.E.C. countries exceeded a million tons for the first time (1,062,000 tons). Sales in the United States in 1955 amounted to 1,468,000 tons, an increase of about 24% over the previous year.

The greatest expansion, both absolutely and relatively (+31%), occurred in the thermoplastics group, which includes polyvinyl chloride and polyethylene.

While very rapid expansion is to be expected for certain plastics, in particular polyethylene, the report concludes that sales of all plastics materials in Western Europe will probably increase over the next two years at a slightly less spectacular rate than in the last five.

Fertilisers. Nitrogen production, including technical nitrogen, was 3% higher in 1955-56 than in 1954-55 and consumption 6% higher. In 1956-57 the rate of increase in production is estimated at 15%. It is expected that consumption will rise by a further 6%. Generally speaking, nitrogen production in all its forms shows a tendency to outstrip demand not only in Europe but in the United States also.

The production of phosphate fertilisers as a whole increased by 2% in 1955-56 and a similar increase is expected in 1956-57. This general tendency was, however, unable to prevent a 4% decline in the production of single superphosphate, as the increase was due to higher output of basic slag and complex fertilisers. Consumption increased by 4%, which suggests a decline in stocks, particularly single superphosphate. During the present year a further increase is expected in total consumption amounting to 2%.

There was a 2% increase in the production of potash fertilisers in 1955-56 and a further increase of 6% is expected during the present year. The present increase in production is not so high as in the last few years. Consumption increased by 6% in 1955-56 and this year a further increase of 4% is expected.

Sulphurous materials. In 1955, the situation improved. The increase in world production of native sulphur, especially in the United States and Mexico, contributed greatly to this improvement. The output of sulphurous materials in O.E.E.C. countries also increased (by 8%) in 1955.

Nomogram:

Specific Gravity of Water as a Function of Temperature

By D. S. Davis

(*Professor of Engineering, University of Alabama*)

SPECIFIC gravities of water at temperatures between 15 and 50°C., correct to 0.01 to 0.03%, can be read from the accompanying chart, which is based on reliable data[2] and was constructed by means of well-known methods.[1]

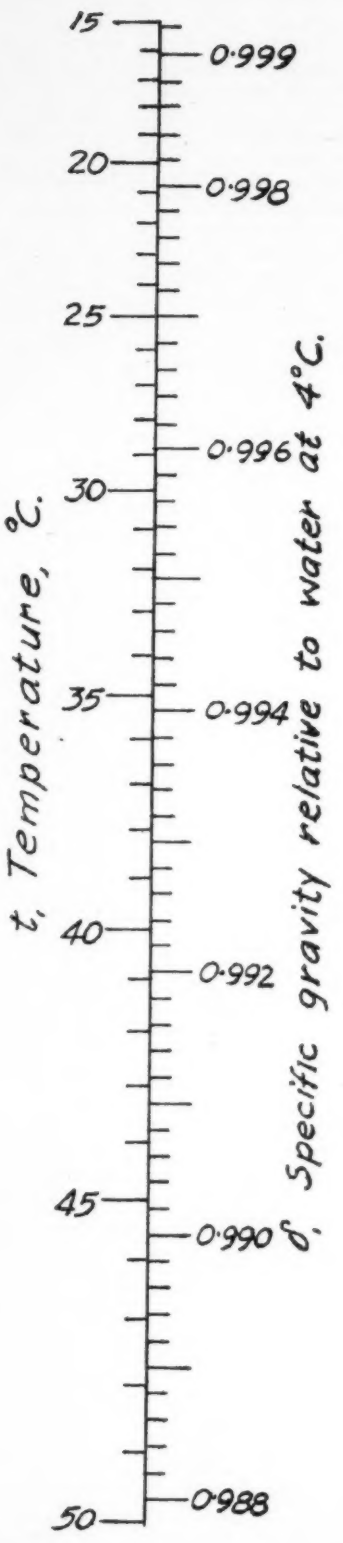
In devising empirical equations and nomographs for the determination of solids in mineral slips in this temperature range, one can use the following equation, which expresses the specific gravity δ of water (relative to water at 4°C.) as a function of the temperature t, in degrees Centigrade:

$$\delta = 1.01699 - \frac{14.290}{940 - 9t}$$

REFERENCES

[1] D. S. Davis, ' Nomography and Empirical Equations.' Reinhold Publishing Corp., New York, 1955.

[2] J. H. Perry, ' Chemical Engineers' Handbook,' 3rd edition, p. 175. McGraw-Hill Book Co. Inc., New York, 1950.



Pure Argon Manufacture

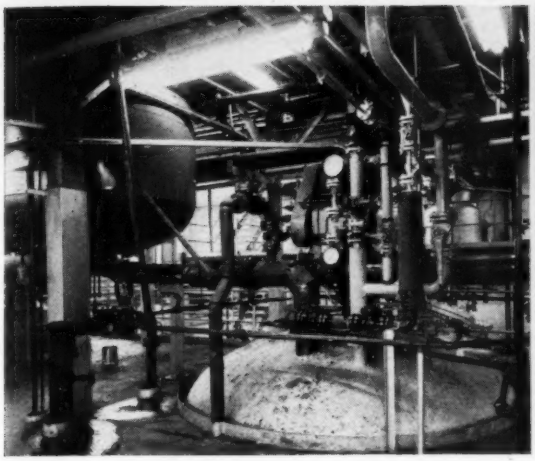
New Soviet Process Claim

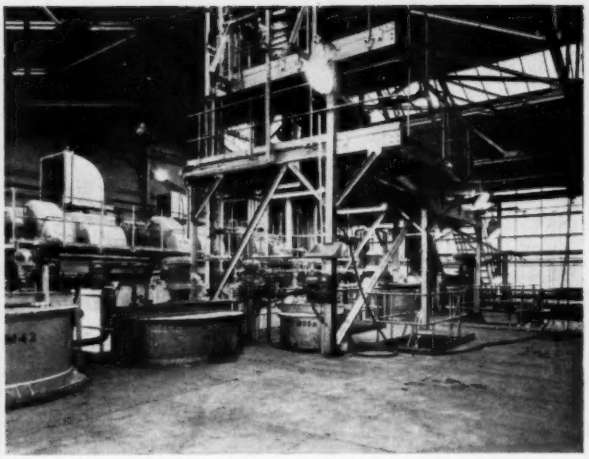
Argon as obtained from the atmosphere contains from 5 to 35% oxygen and 1 to 8% nitrogen. In some applications a high degree of purity is essential. Commercial argon contains up to about 16% nitrogen, whilst in the pure grade nitrogen should not exceed 0.2%. In the former it is necessary to remove oxygen, for which various ways have been tried, including the sulphur, hydrogen and other methods.

What is claimed as a new and improved method of purifying argon, or, more specifically, of removing oxygen therefrom by means of activated copper, is described by N. S. Torocheshnikov and co-workers in *Khim. Prom.*, 1956 (4), 32-38. They note the older methods with sulphur or hydrogen, and various disadvantages therein, especially with hydrogen. In their new one-stage method the oxygen is combined with activated copper at 450 to 500°C., starting at about 230 to 240°C. For development of the process on an industrial scale it was necessary to (*a*) ensure transfer of heat of reaction in oxidising and reduction stages for establishing an auto-thermal process; (*b*) retain sufficient surface activity of the copper for several oxidising/reduction cycles; and (*c*) make the process continuous in one stage.

It was found that various crude-gas mixtures could be used for reduction, such as town gas, coke-oven gas, etc., containing hydrogen, methane and carbon oxides. The various reducing equations, including heat evolved, are given, and the principal agent is CO, at 400°C., with hydrogen also playing an important part. Various points in reduction are stressed, including the need for uniform heating of the thick copper oxide layer. Microscopic examination of the reduced copper granules showed that better results—as to structure—were obtained with the cheap gas mixture (with CO) than with hydrogen; also there was no risk of cracking and formation of amorphous carbon. Reference is made to a similar earlier Soviet process (V. G. Fastovskii *et al.* in the Soviet oxygen journal, *Kislorod*, 1952 (3)), on which the present authors claim an improvement.

A first experimental plant is described and shown, and oxygen removal tabulated, showing 40% at the start, already reduced in 15 min. to 0.005%, and to 0.0 in 30 to 150 min.; after which it rises again to 0.5% in 180 min., 2.2% in 195, and 14.8% in 200 min. The effect of a number of cycles (oxidation/reduction) on extent of use of reaction mass with different contents of oxygen (20% diluted with nitrogen or water vapour, and 40%, in the initial gas) is graphed. Maximum percentage use (45) is with 20% oxygen plus nitrogen. In all cases there is a sharp drop after 1 to 3 cycles down to 3 to 8%, remaining constant then up to about 12 cycles.





Synthetic Rubber for Tyres

DUNLOP'S BIG NEW PLANT IN OPERATION

For the first time in the United Kingdom, the experimental production of synthetic rubber on an appreciable scale has begun at the new plant of the Dunlop Rubber Co. at Fort Dunlop, Birmingham. The overall cost of the plant is estimated at £600,000 and the development of such a plant is evidence of the widening interest in the production of general-purpose synthetic rubber which has previously been noted in CHEMICAL & PROCESS ENGINEERING. *This article describes the features of the plant and some of the processes involved.*

THE new Dunlop plant is the result of many years' research in the fundamental science and technique of synthetic rubbers and development of the manufacture and technology of the products at the Dunlop research centre. Another important factor is the greatly increased production of the necessary raw materials at the large oil refineries now established at Southampton and Grangemouth, which should make possible the economic production of synthetic rubber of the general-purpose type in the United Kingdom.

The complete plant is on a 12-acre site, and the main building housing the reactors, etc., covers approximately 11,000 sq. ft.

Objectives

The main objectives of the plant are the production of general-purpose rubber for tyres, and of new synthetic rubbers as they are developed by the company's central research division. It is intended to produce 1,500 tons of synthetic rubber a year, but this is described as a small-scale experimental plant and has been designed with flexibility of operation in mind, so that it will be able to produce a wide range of synthetic rubbers that may be developed in the future.

The availability of plant facilities of this kind will enable process and plant modifications to be tried out and an important aspect of this first plant will therefore be the opportunity it will present of carrying out large-scale manufacturing and service trials of synthetic rubbers for treads, casings and other parts of the tyre. At the same time a range of other new rubbers will be made and put into service as they become available from the central research division.

Plant and process

The raw materials used at Fort Dunlop are the monomers styrene, from Forth Chemicals Ltd. (whose expanded styrene monomer plant at Grangemouth was described in the December issue of CHEMICAL & PROCESS ENGINEERING), and butadiene, from Imperial Chemical Industries Ltd. These materials are first of all emulsified in a dilute soap solution. Polymerisation takes place by means of catalysts and modifiers. The latex produced by this process is then curdled or coagulated by adding salt and sulphuric acid, and the curds of synthetic rubber are then washed and dried.

From the tank farm, isolated a hundred yards from the main building for safety reasons, the monomers are brought to the pretreatment area for treatment by alkali or distillation to remove the added polymerisation inhibitors, and are then fed to the reactors.

Beyond the reactors is the solution make-up area, where the emulsifiers (soaps) and so on are prepared. The liquids are pumped in metered quantities into the reactors; if cooling is necessary, they pass through a heat exchanger on their way to the reactor. The reactors are of steel, glass lined and water jacketed. Polymerisation is

Pictures above show *left:* part of the reactor area; *Right:* a view of the co-agulating and finishing area.

carried out at a suitable temperature with constant stirring; a range of controlled temperatures suitable for the production of various types of rubber can be obtained—low temperatures are achieved, if required, by circulating cooled brine. The reaction is stopped when the required conversion has been reached. From the blow-down tanks the unstripped latex is piped for stripping of unreacted monomers—butadiene is flashed off and styrene removed by low-pressure stream stripping in patented equipment of Dunlop design. The finished latex passes to storage tanks and from there to the coagulation unit.

The coagulated crumb is freed from surplus serum on a vibrating screen and washed and filtered in a series of operations during which a squeeze-roll conveyor converts it into sheet, which is shredded back to crumb and dried in a three-pass steam-heated drier. The dried crumb is fed to a hopper on the weigher which automatically delivers the required weight to the baling press when, and not before, the baler is ready to receive it. The bale of synthetic rubber is dusted in soapstone, wrapped in a polythene-lined paper bag and stitched up ready for despatch.

Up-to-date methods

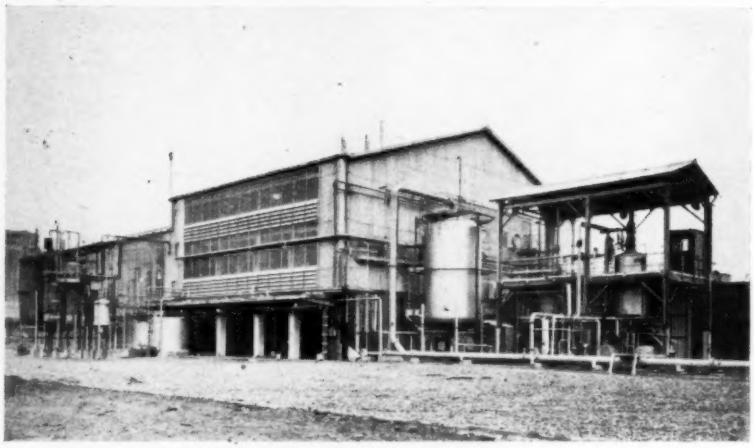
An outstanding feature of the plant is the high degree of mechanisation; most of the operations, once started, continue without further human help. The whole finishing process is automatic until the wrapper is placed in position by hand. Elaborate safety precautions have been taken in the design of the plant, including the use of pressurised switches controlled from a main switch room.

The plant incorporates the most modern methods and improved techniques, derived by Dunlop scientists from their own research and from technical and production advances in Europe and America.

Among the interesting items of plant is a large vessel of polyester glass fibre with a capacity of 500 gal. which holds liquid consisting of approximately 25% brine.

The central research division of Dunlop Rubber Co. was responsible for the overall development of the synthetic rubber processes to be used, also process design, technical liaison and co-ordination of the project throughout.

Foster Wheeler (Great Britain) were responsible for the main engineering contract, including detailed engineering, equipment purchasing and erection supervision. Erection subcontractors to Foster Wheeler were: Toon & Partners (pipework), Allens Erection & Engineering Co. (steelwork), Harris & Sheldon (electrical equipment) and Nadin (insulation, etc.). Switch equipment was supplied by Contactor Switchgear Ltd.



Exterior of the main building.

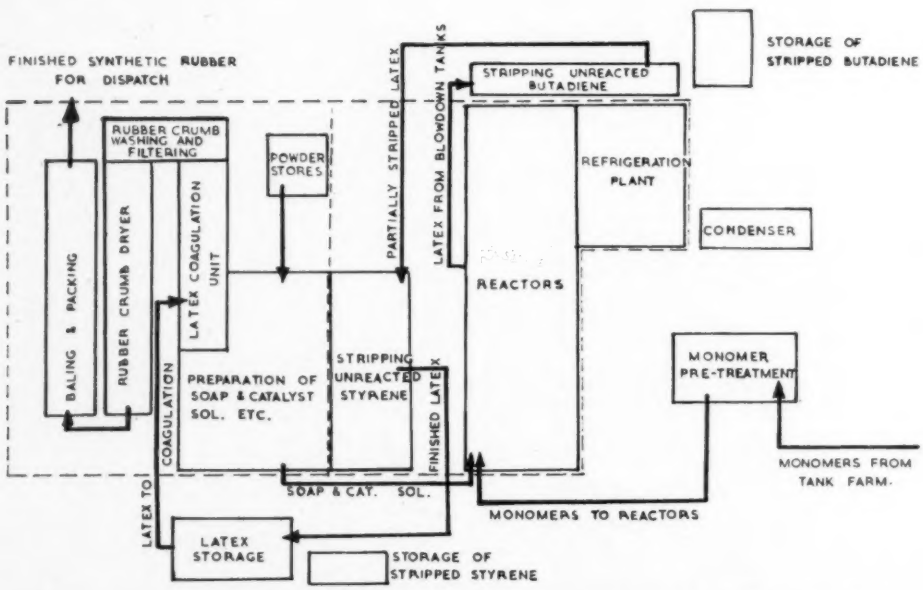


Diagram illustrating the sequence of processes used in the production of synthetic rubber.

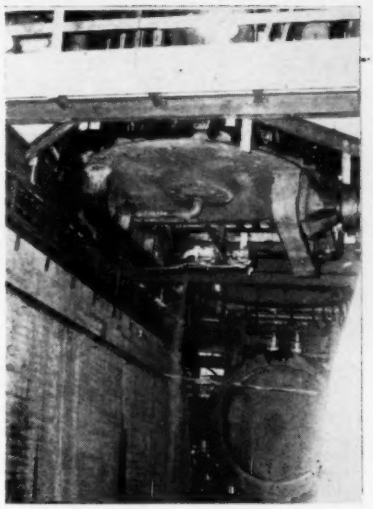
Newsprint from Hardwoods

A new $45-million addition to the U.S. paper industry includes plant that enables hardwood logs to be used in the manufacture of newsprint following chemical pretreatment and grinding. It is expected that, eventually, newsprint will be made from pulp consisting of at least 40% 'chemi-groundwood.' Plant and processes are described below.

BASED on the chemical pretreatment of hardwood as logs, a $45-million expansion programme has recently been completed by the Great Northern Paper Co. at their East Millinocket, Maine, U.S., plant which will increase their production of newsprint to 1,800 tons/day. The installation of the new equipment has followed investigations undertaken by the company's research and control department in collaboration with its manufacturing department and the use of a $325,000, 50-tons/day pilot plant to determine to what extent hardwood could take the place of softwood in the production of newsprint.

In 1953, newsprint consumption in the United States was 6.1 million tons, amounting to 78 lb. *per capita*, about 80% of this being produced in Canada. The estimated consumption for 1960 is 7.5 million tons, or 96 lb. *per capita;* and for 1975, 8.7 million tons, or 112 lb. *per capita*.

With the rapidly expanding markets presenting an increased demand on the United States' softwood resources, considerable effort has been expended in developing satisfactory use of hardwoods that are abundant in many areas, particularly the north-east section of the country.



Underneath the huge, vertical digesters in the chemi-groundwood plant. Note the bolts for keeping each 50-ton door in position, also the hydraulic cylinders on which the doors are hinged.

Development of process

In 1950, a report prepared by Professors C. E. Libby and F. W. O'Neil, of the New York State College of Forestry, covering research sponsored by a group of 28 paper companies incorporated under the name of Empire State Paper Research Associates Inc., showed that the chemical pretreatment of 4-ft. hardwood logs, and then grinding to form pulp, produced a stock that could replace some of the softwood used in newsprint. Further, the lower power requirements for grinding, increased production rates and higher yields per cord from hardwoods result in economic advantages sufficient to approximately absorb the additional costs of steam, chemicals and labour required for the manufacture of chemi-groundwood pulps.

In this chemi-groundwood process, 4-ft. lengths of barked hardwood logs are digested under 175-p.s.i. pressure in a sodium sulphite solution buffered with sodium carbonate and heated to 275 to 300°F. To remove air from the interstices of the logs so that the white liquor will penetrate to the core, the wood-filled digester is evacuated prior to admitting the liquor. By digesting the logs, the lignin binding the fibres is softened and the wood can be ground on the stone wheels.

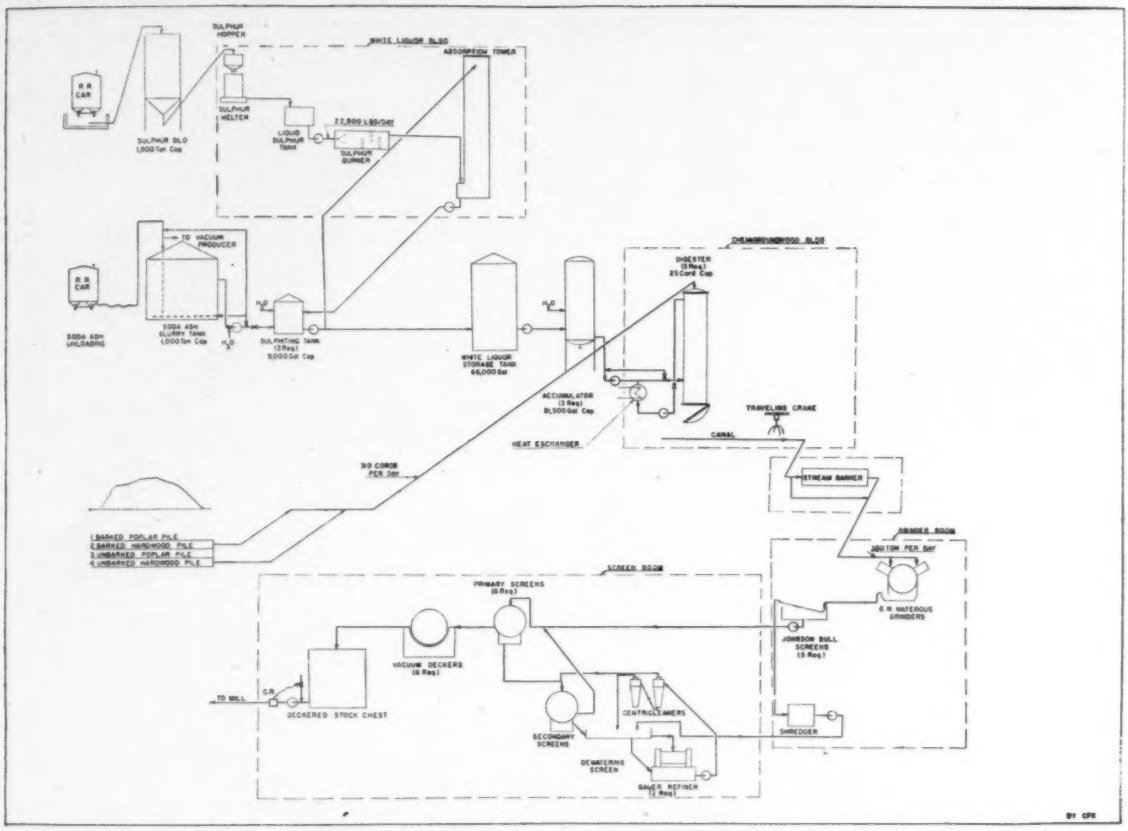
Chemical storage tanks at East Millinocket.

Digesting operations

At the new Great Northern Paper Co. plant the 4-ft. hardwood logs are transported from the woodyard to the top of the 100-ft.-high chemi-groundwood building, where a system of chutes directs the wood to one of four digesters. In order to reduce the labour associated with horizontal digesters, vertical McDonald units, named after Great Northern's president, were installed. These steel tanks are 10½ ft. in diameter and 62 ft. high and have a capacity of 25 cords of wood.

Before the digesters are charged with the logs they are half-filled with padding water to break the fall of the logs. At the top of the digester is a 4-ft.-diameter flanged opening through which the logs enter, while at the bottom is a 16-ft.-diameter, 50-ton door, hinged on twin hydraulic cylinders, through which the treated logs are discharged. Keeping this door in position are 42 bolts, each with its own hydraulic piston and cylinder. A locking ring surrounds the lower digester periphery and serves to prevent the bottom cover from opening in the event of pressure loss in the hydraulic system.

When the digester has been filled



Flow diagram of the 350-ton chemi-groundwood flow system.

the top door is bolted down and padding water is drained off. A vacuum is then applied to the digester to remove the air from the interstices of the wood and this is maintained at about 28 in. Hg for about 45 min. The digester is then padded with steam and the sulphite liquor introduced. By raising the pressure to 175 p.s.i. and keeping up the temperature of the liquor to 275 to 300°F. by circulating it through a stainless-steel heat exchanger, the logs are 'cooked' by impregnation. The time required varies with the different woods, maple and birch needing both higher temperature and longer 'cooking' than poplar, which takes about 3 hr.

At the end of the digestion cycle all the liquor, except of course that absorbed into the pores of the wood, is blown back by steam pressure into an accumulator for re-use and the digester is bled down to atmospheric pressure.

Discharging

The bottom door is opened by a hydraulic release of the locking bolts. Each bolt is suspended from a piston through a rotation-restrained clevis and when, under push-button control, the bolts are released, by being individually pressed down by a hydraulic cylinder and then outward at an angle of 45° from the slots on the pressure head, they swing clear of the door. When all the bolts are free, two large side cylinders slowly drop the gigantic lower head, which is hinged at one side of the digester shell. Some of the remaining liquid and vapour issues from the joint when the bolts are removed, but the vapour is quickly removed by the plant ventilating system and the liquid residue falls harmlessly into the pit below. The whole digester content of 25 cords of wood can be discharged by gravity in the space of a few seconds.

As the huge door slowly opens, first a few, then the whole avalanche of wood crashes down into the concrete pit below, which is partly filled with water to break the fall, to leach the chemicals from the wood, and to cool the logs to permit easier handling. The logs are then transferred by crane to a conveyor through a stream barker to the grinder room. The capacity of each of the digesters is 75 cords/day.

Automatic control

The entire digestion cycle is controlled from a graphic panel on the control floor. The rate of heating and the temperature of the digester are controlled from the board by means of a pneumatic cycle timer specially designed for the application. Also included on the panel are level and pressure indicators and remote switches for controlling pumps and opening and closing all operating valves. So automatised is the plant that all four digesters can be controlled by one operator.

Also remotely controlled is the white liquor plant where the buffered sodium sulphite solution required to replace that absorbed by the wood is made up. Since this alkaline solution is not very corrosive it can be re-used, after fortification, in the cycle.

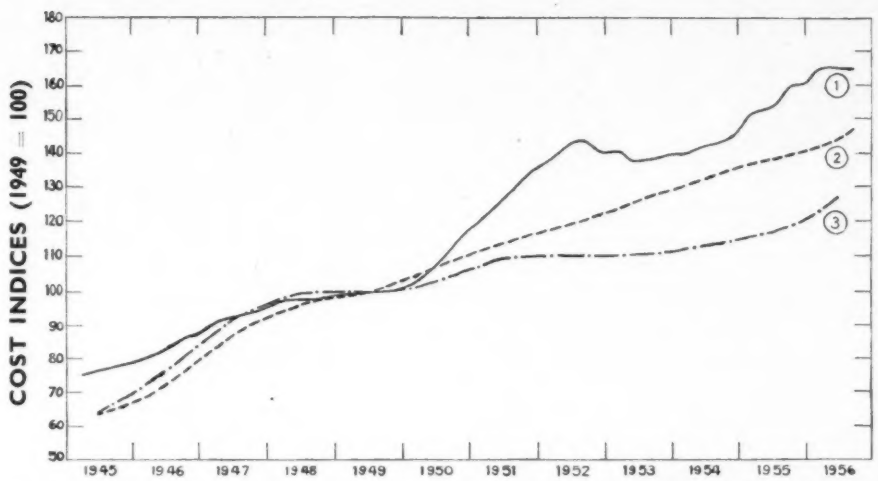
Slurry storage arrangement

Soda ash, one of the starting materials, is received in granular form

(*Concluded on page 74*)

Chemical Plant Construction Cost Index

AMERICAN AND BRITISH INCREASES COMPARED



Graph giving a comparison between U.K. and U.S. cost indices. Curves show: (1) C.P.E. index (British); (2) E.N.R. index (American); and (3) M. & S. index (American).

LAST month we introduced, as a new service for our readers, the CHEMICAL & PROCESS ENGINEERING chemical plant construction cost index; this month we make some comparison between British and American cost increases.

Little is published in Britain on capital costs, whereas much is available in the American literature. Since British chemical engineers must have recourse to American sources for capital cost information it is as well to have in mind the relative rates of increase in construction costs.

The accompanying graph shows a comparison between the CHEMICAL & PROCESS ENGINEERING index and two similar indices published regularly in the United States. One of these is that which appears in the *Engineering News Record*, while the other is the Marshall & Stevens' index, compiled by a Chicago firm of consulting engineers and published in *Chemical Engineering*. This index relates to equipment used in the chemical industry.

Apart from the period of most marked inflation in Britain following on devaluation of the pound and accompanying the Korean war, the construction cost indices for the two countries do not show marked divergencies. Prior to 1949 the rate of increase seems to have been less in Britain. In 1955 British costs showed a marked increase over American.

From June 1945 to the third quarter of 1956 the total increase shown by both C.P.E. and *E.N.R.* indices is the same, namely 2.29-fold. Since June 1949, C.P.E. increases by 1.65 against the 1.47 increase shown by *E.N.R.* Assuming that we 'came out of the wood' in June 1952, we may take it that our normal rate of increase (1.15) is less than in America (1.35). Prior to 1949 the rates of increase 1.39 and 1.56 have very nearly the same relationship to one another as those since 1952.

C.P.E. INDEX—LATEST FIGURE

Our table last month gave the C.P.E. index month by month from January 1945 to October 1956. To this can now be added the figure for November 1956, which is **166.8** (1949 = 100).

To Authors of Technical Articles and Books

The Editor welcomes practical articles and notes on chemical engineering and related subjects with a view to publication. A preliminary synopsis outlining the subject should be sent to The Editor, CHEMICAL & PROCESS ENGINEERING, Stratford House, 9 Eden Street, London, N.W.1.

In addition, the Publishers and Editors of the Leonard Hill Technical Group are always ready to consider technical and scientific manuscripts with a view to publication. Correspondence should be addressed in the first instance to the Book Production Manager, at the above address.

Register of British manufacturers

The Federation of British Industries has issued the 29th edition of its register of the products and services of over 7,000 member firms, a substantial cross-section of British industry. In addition to a classified buyer's guide, there are seven other sections, giving addresses of companies and firms, and useful information about trade associations, proprietary names, trade marks, etc. The register is introduced in a foreword by Sir Graham Hayman, president of the Federation.

**F.B.I. Register of British Manufacturers*, 1957. 29th edition. Federation of British Industries, London, 1956. Pp. 1130. 42s.

Pipeline Planning, Installation and Care

By Leo Walter

Some pointers to greater efficiency in the design, operation and maintenance of pipelines

THE number of pipelines in a plant carrying steam, water and other liquids, or gas and compressed air for processing purposes is usually considerable. Correct piping of fluids is, therefore, just as important for plant efficiency as any other piece of plant equipment and pipework has to be properly planned, correctly installed, and periodically inspected and maintained.

What is called 'preventive maintenance' applies to piping systems in order to keep them in good working order. Where piping extensions may have been added during the years in a haphazard way, overload of mains results. In other instances piping maintenance is either neglected or only performed when something has already broken down. This state of affairs will reflect itself ultimately in a high maintenance bill, in reduced or irregular output and in general dissatisfaction. It does not necessarily follow that in a plant all the deficiencies are present, but if one or the other weaknesses of the piping system can be amended, better working conditions will result. The following recommendations are flexible; no hard-and-fast rulings can be given because working conditions vary from plant to plant. First installation cost plays its part and often limits achievements for improvement.

Piping systems can be classified according to the fluid they convey, or in view of the purpose they serve. Distance, volume, pressure and corrosive qualities of the piped fluid allow for sub-classifications. Fluids conveyed can be compressible, such as air, gases or steam, or can be incompressible liquids. A piping system can cover a small area or can be extended over many square miles. The fluid can be conveyed under high pressure or can flow under low pressure. Volumes handled vary in practice, and so do pipe sizes, and types of fittings for shut-off or for throttling duties.

The over-riding factor is, however, the purpose which the piping system serves. It may be a hot-water distribution system, or a cooling-water system for an I.C. engine with an extended layout. Heating or cooling systems, compressed air systems and steam distribution mains for process work all require careful planning and maintenance and suffer from patch work.

Pipe sizing of steam pipes

It is not intended here to go into the intricacies of pipe sizing, which can be found in textbooks, but rather to suggest a plan for achieving improvements. The first question in a plant survey is whether the pipe size is right for the actual load, and this should be ascertained by rate-of-flow measurements. The use of a portable steam meter is invaluable in steam distribution systems. Oversized steam pipes cause unnecessary heat losses, a costly business. An oversized piping system also requires bigger maintenance costs. The first step for improvement is, therefore, a very careful checking of pipe sizes throughout the plant, by ascertaining what fluid velocities are present and by comparison with standard figures.

Many a surprise will result from these measurements. What should be realised is that a threaded boss or a flanged connection on plant equipment does not indicate the correct pipe size, which latter has to be found by calculation. It is not proposed to discuss correct pipe sizing further, since it is a practical science in itself.

Efficient design of piping

The layout of piping in a new plant is usually placed in the hands of experts. The design of extensions in an existing works may be performed by specialists, but more often than not patchwork methods are applied in connection with piping installations to additional plant equipment.

Any alteration in plant layout can affect piping; for example, steam pipes may be left in place, after a piece of plant equipment has been scrapped, with just a leaky shut-off valve at the end, thus contributing to heat loss; or the number of machines may be doubled, and still be connected to the existing steam mains, with consequent bigger pressure loss and consequent steam starvation.

Correct positioning of valves in pipelines is another point which is much too often treated as of minor

Picture above shows fabricated steam steel expansion loops, fully insulated and protected, at an oil refinery. *(Courtesy: Shaw-Petrie Ltd.)*

importance. Bearing in mind that inaccessible or less accessible valves are difficult to service, or even to operate in case of emergency, wrong positioning of valves has often accounted for trouble. Any reorganisation of piping has to locate valves, steam traps or instruments where they are easily accessible and serviceable. Going around a plant with eyes open for the accessibility of auxiliary piping equipment often discloses to the progressive engineer many peculiar abnormalities and a special regular yearly survey seems worthwhile.

Pipe identification

Preventive maintenance of piping is made easier by using the well-known standard colour scheme for identification. A thorough knowledge of pipework details is also encouraged by keeping available an up-to-date layout drawing and up-to-date notes regarding alterations and extensions. The small and medium-sized plant is worse off in this respect than the larger plant, the latter generally having its own drawing office and maintenance department. There is, however, no need for even a small plant to be without correct up-to-date piping drawings, which can be prepared by a consultant or by a specialised piping contractor, to be ready when required, or can be worked out by the plant engineer from rough pencil sketches. If this plan be supplemented by a full list of all component parts, with their sources and dates of supply, so much the better.

Replacements

Records should also be kept disclosing at a glance any replacements made in pipework during each year. Whether they take the form of a card index, as in a large plant, or just a log book is immaterial, as long as information can be obtained at a glance. Any time a worn-out valve or pipe is replaced, a note should be kept for future reference.

Whenever a replacement in pipework or fittings is wanted, the order for replacement may be sent out by the buying office, but such ' repeat ' orders should be carefully examined by the plant engineer. For example, a certain type of valve might have caused trouble during its much-too-short lifetime, and it might be advisable for the plant engineer to specify something better and to insist on obtaining it in spite of a higher price. Instances of ' grading up ' are numerous. A new valve should perhaps have a stainless-steel renewable seat instead of the brass seat used previously, or it should be of the streamlined seatless type to minimise pressure loss and wire drawing. In another instance it might be advisable to replace an ordinary globe valve by a V-port valve type, which latter is better suited to fine throttling duties.

It can hardly be over-emphasised that a regular, very detailed survey of the whole piping installation should be made at least once a year, unless a major change of methods of manufacture involving the use of high pressures, temperatures and altered pipe volumes makes a special additional survey necessary in the interim. The influence of increased load on pipe strain, expansion, supports, vibration, drainage of condensate, etc., should be carefully studied.

A piping system should also be properly sectionalised. Any individual section of piping should be planned to be cut out at will without the use of blank flanges, etc. Reducing valves or control valves should always be fitted in a bypass with isolating valves, to enable servicing or repair without interrupting the operation of the process.

British Industry Prepares for Fresh Endeavours in Atomic Energy Field

THAT British industry is making an increasingly important contribution to the development of the peaceful uses of atomic energy is emphasised by the recent announcement that a Nuclear Energy Trade Associations' Conference has been formed. The manufacturers concerned in the practical development of nuclear engineering techniques lie in different sectors of the engineering industry which the separate trade associations serve and the N.E.T.A.C. is announced as a permanent means of liaison on matters relating to nuclear energy and associated developments. The founder members are the British Chemical Plant Manufacturers' Association, the British Electrical and Allied Manufacturers' Association, the British Engineers' Association, the Scientific Instrument Manufacturers' Association and the Water-Tube Boilermakers' Association.

The Atomic Energy Authority, meanwhile, have set up a commercial department within their industrial group to handle sales of uranium, plutonium, thorium, graphite and other similar materials for the Authority. Within the general policies laid down by the Authority, this department will be responsible for negotiating terms and conditions of sale, including the determination of selling prices.

New reactor in operation

The U.K.A.E.A. has also announced that reactor No. 2 at Calder Hall has started working, although a considerable programme of technical testing and of experimental work will have to be carried out before the reactor is finally commissioned. When both reactors of the first Calder Hall power station are operating on full power, they will have an installed capacity of 92 mw., of which about 70 mw. will be fed into the national grid.

Atomic power station contracts

The Central Electricity Authority has announced its decision on the tenders submitted for the building of its first two atomic power stations. These will be the first nuclear power stations to be owned by an electricity supply authority. The Berkeley, Glos., contract has been awarded to the A.E.I.-John Thompson Nuclear Energy Co. Ltd., which is jointly owned by British Thomson-Houston of Rugby, John Thompson of Wolverhampton, and Metropolitan-Vickers of Manchester. Value of the contract is between £30 and £40 million. The station is of the graphite-moderated gas-cooled design as employed at Calder Hall, but its output will be in the region of 300 mw.—about five times as great as the Calder station.

Manufacture of plant and site work is expected to be completed in about 3½ years.

John Thompson will be responsible for the manufacture and construction of the large reactor vessels, each 50 ft. in diameter, 80 ft. high and weighing 1,000 tons. Steel plate for these vessels, 3 in. thick, will be processed and rolled in sections at Wolverhampton and welded on site. Thermal shielding for the reactors, in the form of 4-in. steel plate, will also be fabricated at Wolverhampton.

The gas-cooling circuits and heat-exchange towers, of which there are eight to each of the two reactors, are also being produced by John Thompson. These heat-exchange towers are about 17 ft. 6 in. in diameter and 70 ft. high. British Thomson-Houston will be responsible for the design and manufacture of much of the major equipment, including 16 gas circulators (eight for each of the two reactors). These take the form of axial compressors, each being driven by a 2,980-r.p.m. a.c. motor exceeding 3,000 h.p. through variable-speed couplings. B.T.H. will also build the four large 11/132-kv. generator transformers (to step up the generator output to national grid level), together with all the transformers necessary for providing the 6.6-kv. and 415-v. auxiliaries, the rectifiers to feed the station d.c. busbars, and four 600-kw. d.c. generators for diesel-driven standby sets.

Amongst the most specialised features of the station are the control-rod actuators, of which there will be at least 150 per reactor. These will also be designed and manufactured by B.T.H. and will fulfill the dual function of controlling the nuclear power and providing quick shut-down in emergency.

Head Wrightson & Co. Ltd., as a member of the Nuclear Power Plant Co., will undertake a major part of the order for the second of the Central Electricity Authority's power stations —at Bradwell, Essex. The field of work covered by the contract will include the design, supply and construction of the heat exchangers, the installation of the graphite around the reactors and also the supply of shield cooling, blowdown and evacuating systems. The design, supply and construction of the heat exchangers with the boiler drums is a major part of this contract, the supply of which is a co-ordinated venture between Head Wrightson and Clarke Chapman. The net output of this station will be 275 mw.

Another nuclear power project

The C.E.A. has also announced that, subject to the requisite planning permission and approval by the Ministry of Fuel and Power, they propose to erect their third nuclear power station in Somerset. Negotiations were taking place recently with the English Electric-Babcock & Wilcox-Taylor Woodrow group of companies and, if satisfactory agreement is reached, it is intended to start construction on the site as soon as possible.

Newsprint from Hardwoods

(*Concluded from page* 70)

and transferred to the top of a 320,000-gal. tank by means of a Diamond Alkali Co. soda ash eductor. As it enters the tank the soda ash is mixed with recycled saturated solution and stored at 100 to 130°F. as a slurry of monohydrate. The clear saturated solution at the top of the tank is withdrawn and transferred as required to two 10,000-gal. batch tanks where it is diluted with water to 1.8 lb./gal. Whenever solution is drawn off the top of the tank, water is admitted at the bottom where it becomes saturated in contact with the slurry. A constant liquid level is thus maintained at the top of the tank. Continued withdrawal of solution reduces the slurry level and additional granular ash must be added before it is all dissolved. This is one of the first slurry storage systems in the industry.

Sulphiting

The batch of soda ash is circulated through a stainless-steel absorption tower containing Stone & Webster ripple trays, where it is contacted with 16% SO_2 gas from a spray sulphur burner, the sulphur being melted in Hamilton melters and pumped by a steam-turbine-driven centrifugal pump to the spray nozzle at the burner.

As soon as a batch is completely sulphited, the second batch tank is switched at the graphic control panel by a remotely operated four-way valve into the absorption system. The sulphited batch is buffered by adding soda ash and then stored in a 66,000-gal. tank until required as make-up in one of the accumulators where the used solution is stored between cooks. The entire system is operated by one man from the graphic panel adjacent to the digester panel.

To handle the eventual requirement of 450 tons/day of hardwood the sulphite plant is designed to produce 48,600 gal./day of white liquor. Approximately 15% of the liquor used in each cook must be replaced by fresh white liquor.

At the present time, commercial newsprint is being produced by the Great Northern Paper Co. from pulp consisting of 30% chemi-groundwood, 15% sulphite pulp and 55% ground softwood. It is expected that, with further development, it will be possible to use at least 40% of chemi-groundwood.

Grinding

On being conveyed from the woodyard to the grinder room, the softwood is ground on three lines of six Great Northern Waterous 67 × 54 in. grinders rated at 40 tons/day each, with the pretreated hardwoods being ground on one line of two similar grinders rated at 75 tons/day each. Each line of two grinders is driven by a 6,000-h.p. motor of Westinghouse manufacture. Both the softwood and hardwood ground fibres are then screened through separate screens *en route* to the stock chest. The rejects from the screens go to shredders, tailing screens and refiners before returning to the system.

Claimed to be one of the highest steam pressure plants in the newsprint industry, the power plant is sheathed with insulated aluminium. The two boilers, each designed to produce 300,000 lb. of steam an hour at a pressure of 1,300 lb. and a temperature of 855°F., are adaptable for either oil or coal firing. Two 12,500-kw. turbine generators act as pressure reducers for the 1,300 lb. steam by extracting at the ninth stage at 200 p.s.i. gauge. This 200 lb. steam supplies the turbines that drive the paper machines, the turbines being tied in with the Great Northern hydro-electric system. Boiler make-up water is purified in a complete de-ionising plant. The demineralised water averages at less than 1 p.p.m. dissolved solids and less than 5 microhms conductivity.

Stone & Webster Engineering Corp., of Boston, U.S., were engaged for the general construction of the new East Millinocket extension and for the design and engineering of the high-pressure power plant and the new chemi-groundwood plant. The design and engineering for other necessary additional plant, as well as the overall co-ordination of engineering, was undertaken by Great Northern's engineering department.

ISOMERISATION of Light Naphthas

Economical New Process Uses Precious-metal Catalyst

A NEW process for isomerising light naphthas has just been announced by the Kellogg International Corporation, London, subsidiary of the M. W. Kellogg Co., New York. The process, called *Iso-Kel*, is designed to help refiners increase their high-octane pool by upgrading combined streams of pentane and hexane fractions as well as natural gasolines.

Increasing the octane quality of straight-run naphthas and natural gasolines by isomerisation of the pentanes and hexanes in one process unit offers marked economic advantages to refiners (see Table 1).

One advantage of the new process is that it produces two separate products: (1) an isopentane stream of 104.9 CFRR + 3 c.c. TEL, and (2) an isohexane stream of 89 to 92 CFRR + 3 c.c. TEL, depending on the feedstock. The isopentane stream can be allocated for the super premium gasoline; the isohexane stream for the housebrand. When charging light naphtha, the combined streams have an overall yield of 97 vol.% and an octane number of about 96 CFRR + 3 c.c. TEL. When feeding natural gasoline, overall yield is 99 vol.% and octane number about 99.8 CFRR + 3 c.c. TEL.

The advantages of *Iso-Kel* rest on a new, precious-metal catalyst (not platinum) developed in Kellogg's research laboratories. This vapour-phase process requires only one reactor, which operates in the presence of hydrogen. There are no corrosive elements in the system and operating conditions are less severe than those for reforming heavy naphtha.

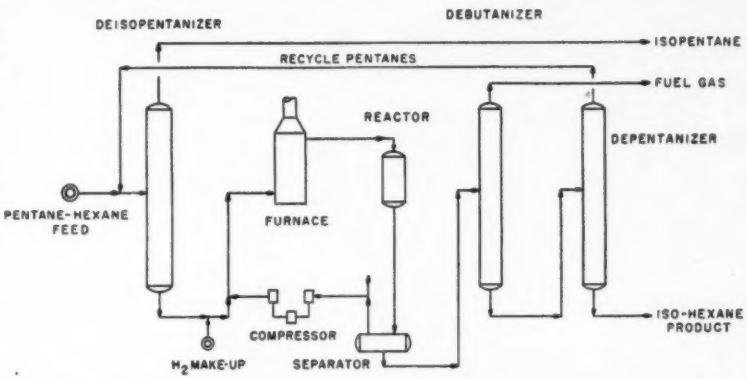
Economic soundness of the *Iso-Kel* process is illustrated in the case of a 50,000 bbl./day refinery, where a 3,100-bbl./day *Iso-Kel* unit would have a payout of about 19 months. Payout time can be further reduced when existing equipment can be utilised.

Processing scheme

Depending upon quality of feedstock and degree of upgrading desired, the process flow sheet (see Fig. 1) can be varied to allow for prefractionation of isomers in the feed, and recycle of unconverted material. Economic calculations indicate that, in general, it is preferable to process pentanes on a recycle basis, and to process hexanes once through.

The mixed feed is charged to a deisopentaniser, where it is joined by pentane isomerisation product. The isopentane present in both the fresh feed and reactor product is taken overhead, and the bottoms are sent to the reactor. Hydrogen-rich gas is charged

(*Concluded on page 78*)



Simplified flow diagram of M. W. Kellogg 'Iso-Kel' isomerisation process.

Table 1. Research Octane Numbers of Pentane and Hexane Isomers

	*Research octane number**	
	Clear	+ 3 *c.c. TEL*
n-pentane	61.7	88.7
i-pentane	92.3	105.7
n-hexane	24.8	65.3
2 methylpentane	73.4	93.1
3 methylpentane	74.5	93.4
2, 2 dimethylbutane	91.8	104.3
2, 3 dimethylbutane	102.7	108.9

**Octane numbers above* 100 *by formula:* $ON = 128 - \frac{2{,}800}{PN}$

Table 2. Isomerisation of Pentane-Hexane Fraction from Commercial Stocks

	Kuwait		*Mid-Continent*		*Nat. Gasoline*	
	Feed	*Product*	*Feed*	*Product*	*Feed*	*Product*
Total C_5-C_6						
Vol.%	100.0	97.3	100.0	96.7	100.0	99.2
Octane CFRR-Clear ...	63.7	77.7	62.1	77.0	72.3	83.3
+ 3 c.c. TEL ...	88.3	96.2	87.3	95.8	93.9	99.8
Pentane Fraction:						
Vol.% of total C_5-C_6	45.0	45.0	34.5	34.5	58.5	58.5
Octane CFRR-Clear	74.4	91.0	72.9	91.0	79.2	91.0
+ 3 c.c. TEL ...	95.8	104.9	94.9	104.9	98.4	104.9
Hexane fraction:						
Vol.% of total C_5-C_6	55.0	52.3	65.5	62.2	41.5	40.7
Octane CFRR-Clear	54.9	66.3	56.4	69.2	62.6	72.2
+ 3 c.c. TEL ...	82.2	88.7	83.3	90.7	87.5	92.4

British Patent Claims

Titanium-clad steel

One side of a titanium sheet is coated with iron or nickel by electroplating and the coated face is placed against a steel backing plate. The other side has a steel cover plate applied thereto with an immediate parting material. The assembly is sealed peripherally, inert gas is flowed into it, and heating is effected simultaneously to promote bonding of the sheet and backing plate. The assembly is then reduced by rolling, etc., to an extent sufficient to effect bonding.—759,413, 759,468 *and* 759,469, *Lukens Steel Co.* (*U.S.*).

Vessel for hot corrosive substances

A lining of graphite bricks, etc., provides a connected channel system for a heating or cooling medium, and a heat-insulating elastic layer is provided between the lining and the vessel wall.—759,506, *C. Conradty* (*Germany*).

Mineral separation

Selective separation of a mineral from earthy material is effected by boiling an aqueous slurry, adjusting the *p*H value, adding flotation agents, cooling to a specified temperature, and then subjecting the slurry to flotation.—759,564, *Molybdenum Corporation of America* (*U.S.*).

Drying of chemicals, paint pigments, etc.

A pump rotor mounted on the lower part of a hopper co-operates with the hopper side walls to force material through a grid in the form of strands for drying, *e.g.* on a mesh conveyor.—759,155, *Petrie & Mcnaught Ltd., et al.*

Powder mixer

A central cylindrical section of a mixer container is between frustro-conical end sections of different base angle. The horizontal axis of rotation is between the smaller outermost ends of the end sections.—759,507, *Apex Construction Ltd., et al.*

Deacidification of ammoniacal scrubbing liquid

The NH_3 liquor, containing H_2S and CO_2, is indirectly heated in heaters operated in series, and passed from each heater into an associated deacidifying stage; the gases leaving the heater are introduced into a back-washing stage at the top of the deacidifier and NH_3 is washed back out of the ascending gas. The process is used to recover ammoniacal liquor used in the removal of H_2S from coke-oven gas.—759,286, *F. J. Collin A.G.* (*Germany*).

Fluidising acid sludges

A viscous H_2SO_4 sludge, from petroleum oil treatment, is mixed with a small proportion of a fluidising agent containing $<$one phenol and $<$one organic acid (*e.g.* naphthenic), which is the mixture obtained by acidification of spent caustic soda used for treatment of non-acid-treated cracked petroleum oil.—759,357, *Esso Research & Engineering Co.* (*U.S.*).

Alkyd resins

The resins are produced by heating, at 100 to 550°C., a mixture of a polycarboxylic acid, a polyhydric alcohol, an unsaturated monobasic aliphatic acid and a hydrolysable polysiloxane. The aliphatic acid is copolymerised (before, during or after reaction) with an olifinic monomer. The resins are used in the production of paints and varnishes, particularly baking enamels.—759,197, *L. Berger & Sons Ltd.*

Purification of phenol

Phenol produced by acid decomposition of isopropylbenzene hydroperoxide is purified by contacting, in the liquid phase, with hexane (boiling point range, 62 to 67°C.), allowing the mixture to separate into two phases and recovering the phenol phase.—759,347, *Distillers Co. Ltd.*

Filter plant

An automatically-operating two-way valve connects an outlet from a filter thickener to either of two delivery pipes, one of which leads to a discharge while the other leads to a container connected to the thickener. The valve reverses when pressure balance occurs across it, and the container is alternately vented and supplied with compressed air by a two-way valve which is reversed at predetermined time intervals. — 760,272, *Norsk Hydro-Elektrisk Kvaelstofaktieselskab* (*Norway*).

Pressure reaction vessels

A vessel provided with an agitator comprising an electric motor within a housing with a shaft provided with rotatable blades which extend into the reaction section of the vessel; the housing is entirely within the vessel and is discontinuous above the surface of a cooling fluid surrounding the motor, so that the pressure on the cooling fluid is equal to the pressure in the vessel surrounding the housing.—760,511, *Union Carbide & Carbon Corp.* (*U.S.*).

Purification of naphthalene

S-compounds are removed from naphthalene by treating at $>$melting point with para-formaldehyde under acidic conditions in the liquid phase, and the naphthalene is subsequently hydrogenated with a non-S-tolerant catalyst. — 760,054, *Yorkshire Tar Distillers Ltd.*

Viscometer

In an instrument of the kind in which the passage of a solid body through a test liquid is timed, such body is metallic and passed through the spaced coils of an electrical bridge network past a detector.—758,199, *R. A. P. Wertheim.*

Temperature control of catalytic chemical reactions

The heat generated by exothermic, preferably heterogeneous, catalytic reactions of homogeneous gaseous or liquid reactants is removed by indirect cooling with a countercurrently flowing medium. The reaction temperature along the flow path of the reaction mixture is maintained at predetermined values by controlling (*a*) the temperature of admission of the cooling medium and (*b*) the throughput of cooling medium in unit time; both factors are controlled independently of each other and of the amount of reaction mixture passing through the reaction zone. The apparatus is also claimed.—758,538, *H. P. A. Groll* (*Sweden*).

Contacting liquid and vapour or gas

A bubble tray comprising a perforated plate having depressions for creating zones of liquid of different static head in a body of liquid supported by the plate; the openings in the plate provide the sole passage-way for the upward and downward flow of fluid.—758,278, *Stone & Webster Engineering Corp.* (*U.S.*).

The above abstracts are reproduced from the weekly Patents Abstracts Journal *by permission of the Technical Information Co. The complete specifications can be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, price 3s. each.*

★ Personal Paragraphs ★

★ **Dr. R. Holroyd,** director in charge of research, has been elected a deputy chairman of Imperial Chemical Industries Ltd. in place of **Mr. A. J. Quig,** who is retiring after nearly 50 years' service with the company and its predecessors. There are two other I.C.I. deputy chairmen, **Mr. S. P. Chambers** and **Sir Ewart Smith.**

★ **Dr. A. Parker,** C.B.E., director of fuel research in the Department of Scientific and Industrial Research since 1943, has retired after 28 years' service with the department. The Council for Scientific and Industrial Research have appointed **Dr. A. C. Monkhouse** to be acting director of fuel research.

★ **Mr. J. H. Whitney,** the newly appointed ambassador from the United States to the United Kingdom, is chairman of the board of Freeport Sulphur Co., which has strong trade ties with the United Kingdom. F. W. Berk & Co. Ltd. act as distributors of sulphur for the Freeport company to the British chemical, fertiliser and other industries.

★ **Mr. C. E. Evans,** O.B.E., previously general manager of British Hydrocarbon Chemicals Ltd., at Grangemouth, has been appointed general manager of the Distillers Co. Ltd., and **Mr. D. Blair Watt** has been appointed works general manager at Grangemouth.

★ **Mr. F. P. Barribal** and **Mr. J. A. Paul** have been appointed directors of Mobil Oil Co. Ltd. Mr. Barribal has been automotive general sales manager since 1952 and his portfolio as a director will comprise all departments and sections concerned with the retail marketing of automotive fuels and lubricants. Mr. Paul, who has been manager of supply department since 1953, will continue to manage that department. In addition he will assume responsibility for the wholesale lubricating oils and foreign shipping departments.

★ Three changes have been made in the board of the dyestuffs division of Imperial Chemical Industries Ltd. **Mr. S. Howard,** formerly division joint sales director, has been appointed division managing director jointly with **Mr. H. Jackson** and **Mr. H. Smith. Dr. H. Samuels,** formerly joint deputy north regional manager, has been appointed division home sales director. **Mr. R. M. Gibb,** formerly head of dyestuffs division distribution centre, has been appointed a division director in charge of commercial services.

Dr. R. Holroyd.

★ The following awards of Institute of Metals medals have been announced. The Institute of Metals (Platinum) Medal for 1957 has been awarded to **Dr. M. Cook,** F.I.M., joint managing director, Imperial Chemical Industries Ltd., Metals Division, in recognition of his outstanding contribution to the science of metallurgy, to the non-ferrous metals industry and to the welfare of the metallurgical profession. **Dr. H. K. Hardy,** A.R.S.M., A.I.M., research manager, U.K.A.E.A. industrial group, has been awarded the Rosenhain Medal for 1957, in recognition of his outstanding contributions to knowledge in the field of physical metallurgy.

★ **Mr. E. L. Harrison,** sales director, has completed 21 years' service with Quickfit & Quartz Ltd. He became works superintendent at the Stone factory, and sales manager in 1953, having previously been commercial sales manager.

★ Two new sales appointments have just been announced by the Chloride Group of companies. **Mr. T. Dawson** has taken up the new post of group export sales manager and will, in addition, be responsible for commercial liaison with the group's overseas associate companies. **Mr. P. C. Aspinall,** who was assistant export manager, becomes the new export manager for Chloride Batteries Ltd.

★ **Mr. H. F. Tremlett** recently took up his appointment as deputy director to the British Welding Research Association at Abingdon research station. He is a member of several B.S.I. and Institute of Welding technical committees and has served for a number of years on various committees of B.W.R.A.

★ The B.W.R.A.'s chief metallurgist, **Mr. H. E. Dixon,** has accepted a senior appointment with Richardson Westgarth Atomic Ltd. During the past eight years he has made most valuable contributions to the B.W.R.A. researches. He has been succeeded in the post by **Mr. P. T. Houldcroft,** his former deputy.

★ **Mr. K. C. Loughlin** has been elected executive vice-president of Celanese Corporation of America. The position is a new one and will carry broad corporate administrative responsibilities.

★ Amber Pharmaceuticals Ltd. have announced the appointment of **Mr. F. de Buda** to the board of the company. He will be concerned with the development and marketing of the products of Amber Industrial Chemical Treatments (a division of the company).

★ **Mr. O. Secher,** joint sales director of Marchon Products Ltd., has now taken on the additional responsibility of chemical products sales, which has in the past been in the hands of **Mr. B. B. Dugan,** who is emigrating with his family to South Africa, where he will continue his association with the company by becoming a director of Chemical Services (Proprietary) Ltd., who are Marchon's agents in South Africa.

★ **Mr. H. J. Eichenhofer** has been named area manager of Pennsalt Chemicals (U.S.) Wyandotte operations, in which capacity he will be responsible for the direction of the integrated activities of Pennsalt's east plant and the west plant formerly identified as the Sharples unit.

★ The export sales manager of Joseph Crosfield & Sons Ltd., **Mr. A. Melbourne,** is making his third extensive overseas tour in connection with the sale of the company's alkaline cleaning products, etc.

★ Silvertown Rubber Co. Ltd. have announced the retirement after 60 years' service of one of their veteran employees, **Mr. J. Lines,** who joined the company in 1896 at the age of 14 and worked in the preparation department of the company's factory at Silvertown.

COMPANY NEWS

The Head Wrightson Export Co. Ltd., a subsidiary of Head Wrightson & Co. Ltd., of Thornaby-on-Tees, have opened an office in Calcutta at 21 Netaji Subhas Road, Calcutta 1. This office will act as headquarters in India of Head Wrightson's staff, who are working on the large Durgapur steel plant project.

*

The telephone number of Ronald Trist & Co. Ltd., Bath Road, Slough, Bucks, has been changed to Slough 25041.

*

The Chemische Werke Huels have announced that they have set up their first subsidiary abroad—the Quimica Industrial Huels do Brasil Ltd. at Sao Paulo, Brazil. The subsidiary will deal with the production and sale of chemical goods and may also acquire interests in foreign firms. The subsidiary had already bought a share in the Companhia Brasileria de Estireno.

Chemische Werke Huels are the sole producers of synthetic rubber in West Germany. They are also prominent manufacturers of plastics, raw materials for lacquer production and organic and inorganic chemical goods.

*

Shell Chemical Co. Ltd. recently announced price revisions for its chemicals, brought about by increases in the cost of manufacture. It was stated that there was no reason to anticipate any interruption of supplies at present.

*

Weinreb & Randall Ltd., tower packing and distillation specialists, are moving to new premises at Watchtower Works, Greenside Road, Croydon (telephone, Thornton Heath 8696). This will bring their office and warehousing facilities under one roof, together with production capacity for Raschig rings and other distillation specialities.

*

Koppers Co. Inc., of Pittsburgh, U.S., is to invest between $100 million and $125 million in new plants and equipment within the next five years, with about two-thirds of all capital expenditures earmarked for programmes which will ensure the firm's continued growth in the chemical industry.

Last year capital expenditures were about $21 million, of which about 70% was for programmes of the chemical and tar products divisions. Based on 1956 sales estimates, Koppers sold about $42 million-worth of chemical products it did not have 10 years ago —principally polystyrene, polythene, resorcinol resins, antioxidants, anilines and dyes.

MEETINGS

Institution of Chemical Engineers

February 21. 'The Processing of Nuclear Reactor Fuels,' by R. Spence and C. M. Nicholls, 5.30 p.m., Royal Institution, Albermarle Street, London, W.1. Held in conjunction with the British Nuclear Energy Conference.

February 23. Symposium on 'Modern Developments in the Use of Plastics in the Chemical Industry,' 2 p.m., Reynolds Hall, College of Technology, Manchester. Joint meeting of North-Western Branch with the Graduates' and Students' Centres in the north-west area.

Society of Chemical Industry

Chemical Engineering Group

February 12. 'Some Aspects of British Standards in Relation to Chemical Engineering in the Chemical Industry,' by D. E. B. Greensmith, 5.30 p.m., 14 Belgrave Square, London, S.W.1.

Institution of Mechanical Engineers

February 15. 'Some Engineering Problems in the Industrial Development of Nuclear Energy,' by Sir Claude Gibb, 6 p.m., Church House, Westminster, London, S.W.1. General meeting in conjunction with the British Nuclear Energy Conference.

Chemical Society

February 8. 'Some Current Problems in Phase Transitions,' by Prof. A. R. Ubbelohde, 4.30 p.m., Chemistry Department, The University, Birmingham.

February 15. 'Some Recent Developments in the Chemistry of Metallic Surfaces,' by Prof. K. W. Sykes, 8.30 p.m., University Chemical Laboratory, Pembroke Street, Cambridge.

February 18. 'Silicones and their Industrial Applications,' by R. Nattrass, 6.30 p.m., Chemistry Lecture Theatre, The University, Leeds. Royal Institute of Chemistry Lecture.

Incorporated Plant Engineers

February 21. 'The Application and Maintenance of Centrifugal Pumps,' by G. O. Stevenson, 7.30 p.m., Golden Lion Hotel, Blackburn.

Institute of Metals

February 7. 'Beryllium,' by Bengt Kjellgren, 6.30 p.m., 17 Belgrave Square, London, S.W.1.

February 13. 'Titanium,' by J. W. Rodgers, 6.30 p.m., Manchester Room, Central Library, Manchester.

Institution of the Rubber Industry

February 11. 'Polyester Isocyanite Foams,' by Dr. J. T. Watts, 7.15 p.m., Bull and Royal Hotel, Church Street, Preston.

Society of Instrument Technology

February 14. 'Process Control Analysis,' by J. McMillan, 7.30 p.m., Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough.

February 27. 'Some Application Problems in Fluid Flow Measurement,' by B. W. Balls, 6.45 p.m., Physics Lecture Theatre, Cardiff College of Technology.

Isomerisation of Light Naphthas

(*Concluded from page* 75)

to the reactor with the feed, and separated from the effluent for recycle.

The process is nearly self-sufficient for hydrogen, and only a small quantity of hydrogen make-up is necessary. The reaction product from the separator is debutanised and depentanised.

The hexanes are isomerised once through, with only a small incremental investment over pentane isomerisation alone. Further upgrading, at greater cost, could be achieved by the addition of a deisohexaniser and an auxiliary depentaniser to remove the isomeric hexanes in the feed or to give complete recycle of n-hexane.

Yields and quantities calculated for processing three light naphthas of varying crude source are shown in Table 2. These calculations were based on experimental data obtained from processing pentanes and hexanes.

WHAT'S NEWS about

★ Plant
★ Equipment
★ Materials
★ Processes

This illustrated report on recent developments is associated with a reader service that is operated free of charge by our Enquiry Bureau. Each item appearing in these pages has a reference number appended to it; to obtain more information, fill in the top postcard attached, giving the appropriate reference number(s), and post the card (no stamp required in the United Kingdom).

Flame-proofing timber

The increase in demand for pressure flame-proofed timber has led to the development of flame-proofing treatments to produce maintenance-free timber for buildings and structures designed to be fire safe and where corrosive conditions are found. *Pyrolith* flame retardant preservative is impregnated into timber by vacuum/pressure impregnation in the form of an aqueous solution. On re-drying, the water is lost to atmosphere and the *Pyrolith* salts are left deeply impregnated in the wood fibre and cell cavities of the timber.

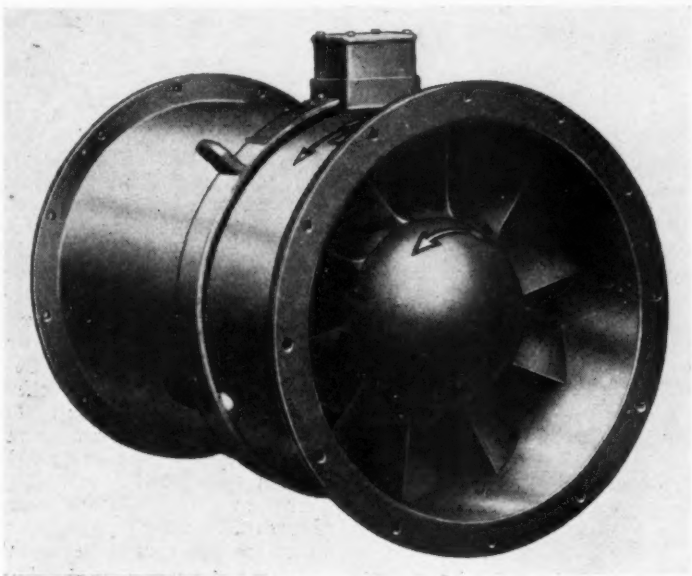
Timber treated by this method effectively resists the rapid spread of flame and its stability when exposed to fire has been demonstrated. Treated timber has been used successfully in a coke cooling plant, in chemical plant, dyehouses, tanneries, foundries and in parts of coalmines subject to fire hazard. **CPE 484**

Fans for direct extraction of acid fumes

The introduction of a complete range of axial-flow fans of rigid PVC has been announced. The use of these fans now enables the direct extraction of acid fumes through ductwork, with the fan fitted on-line.

The motor is encased in a PVC housing, thus ensuring the minimum air flow interruption and complete protection for the motor. The motors for such application all have insulated electrical connections and winding double-impregnated. Arrangements are made in the construction whereby the motor can 'breathe' freely and yet not come into contact with the acid fume.

Following axial-flow practice, these fan units are mounted direct into the duct and give maximum extraction efficiency. They effectively handle corrosive fume at 70°C. **CPE 485**



Axial-flow fan.

New automatic arc welding process

The *Fusarc*/CO_2 process is a new method of automatic arc welding. Used for the welding of mild steel, the equipment has, it is claimed, the following advantages: high welding speed; easy de-slagging and consequent reduction of man hours; high quality of weld metal; good radiographic results of the weld metal; less spatter and consequent reduction in cleaning time; smooth finish of the final weld, and improved control of penetration.

The electrode consists of the *Fusarc* patented type of continuous covered electrode with a newly developed type of covering, and this is used in con-

C.P.E.'S MONTHLY REPORT AND READER SERVICE

junction with a carbon dioxide gas shield. This combination of flux and gas shielding allows considerably higher welding speeds than can be achieved with flux alone, and the deposited weld metal is of a high metallurgical standard, it is stated.

The new process is further claimed to have considerable tolerance towards ineffectively cleaned surfaces, mill scale, rust and dirt, and moreover allows horizontal-vertical fillets of a very high standard to be deposited by an automatic open-arc process for the first time.

Fusarc/CO_2 No. 1 electrode is the first electrode specially developed for use with a CO_2 gas shield, the makers state. This is a general purpose electrode for horizontal-vertical fillet welding, single and multipass butt welding, and for fillet welding in the flat position. **CPE 486**

Automatic self-cleaning air filter

The double-bank filtration and positive automatic cell cleaning of a *Reciprojet* air filter, the makers believe, make an immediate appeal to engineers requiring air filtering equipment capable of handling heavy dust loads for long periods with the minimum of manual attention. The filter has proved specially satisfactory for ventilating equipment supplying air to electrical machinery in steelworks, collieries and similar plants.

Its principal features are automatic operation controlled by a time switch, ensuring that each cell is thoroughly cleaned at regular and frequent intervals, and double-stage filtration which ensures high efficiency of air cleaning. Positive cleaning of filter cells without removal takes place by means of non-choking reciprocating oil jets.

CPE 487

PAINTING ON WET SURFACES

Treatment for paints which enables them to defy surface water has been developed by a paint manufacturing firm. Their proprietary brands so treated are marked as 'hydro treated,' in addition to the normal label. The treatment imparts to the paint the property of uniting firmly to damp surfaces (when applied by brush), the treated paint striking deeply into the pores in spite of the water. **CPE 488**

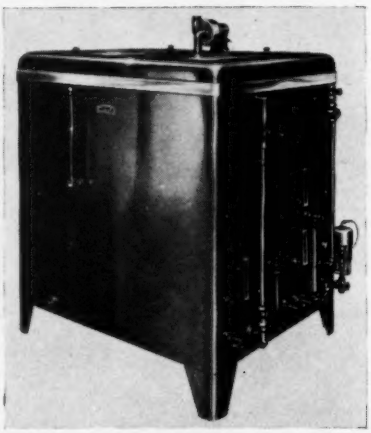
Photoelectric temperature control

Intended for temperature control in the range of approximately 750°C. upwards, two new photoelectric units will be of interest to those concerned with the heat treatment of metals, including welding, annealing, hardening, resistance welding and similar processes, where the colour temperature of the heated object can be detected by the photocell.

The temperature limit switch PA4T provides switch off of the heating current when the temperature of the workpiece has risen to the desired limit. Variations of heating time due to supply voltage fluctuations do not alter the temperature switch-off point.

The temperature controller PR5 provides on-off switching at predetermined temperatures, thus enabling a given temperature to be maintained.

Both units are used with a separate viewing head PH2, which consists of a cast aluminium housing enclosing the photocell and is fitted with an optical system of adjustable focus through which the incandescent object is viewed. The viewing head may be as little as 3 in. or as much as 24 in. away from the object, always provided that enough light is emitted by the object at the critical temperature to obtain adequate response from the photo-cell. Size of the viewed object may vary from $\frac{3}{16}$ in. diam. upwards, subject to similar considerations. The housing has a gasketted removable rear cover to facilitate focussing, inspection, and replacement of the photocell. The head is secured in a cast trunnion bracket enabling it to be aligned and then securely bolted in position. The photocell leads to the control cabinet are contained in flexible metallic conduit supplied with the equipment. **CPE 489**



RECONDITIONING OIL

Of particular interest at this moment, in view of the oil crisis, is an oil conditioner which has been particularly designed efficiently to condition turbine or other low-viscosity, high-demulsibility oils containing dirt and other foreign matter; for removing water (either emulsified or 'free'), and is especially valuable for such oils requiring acid correction. At the moment, it is made in one size only, with a capacity of 45 *to* 90 *gal./hr., but will subsequently be available with capacities up to* 1,080 *gal./hr.*

With this unit, oil is not merely filtered but truly reconditioned—making it highly resistant to sludging and acid formation, permitting the oil to perform efficiently indefinitely. Power consumption is negligible and there is no wear or other high operating or maintenance expense. **CPE 490**

Portable heat-sealing device

Fitted with adjustable clamps to fit on to any table, bench or work-surface, the SC-200 heat-sealer is capable of producing a strong heat-seal on most types of thermoplastic films and other heat - seal - coated materials.

The electrical loading is very low, so that it is possible to leave the apparatus switched on all day without risk of overheating, the built-in thermostat allowing for an exact regulation of the working temperature. Heat-sealing is effected by a heated blade, operating through an intermediary layer which prevents sticking.

Novel feature of the device is the employment of an intermediary layer which consists merely of regenerated cellulose (viscose) film. This assures a high-grade seal, yet permits of numerous heat-seals being effected without need for replacement. When replacement is necessary, ordinary strips of cellulose film about 500 or 600 mm. wide may be used.

The heat-sealing operation consists of three movements only: (1) introducing the free edges of the polythene or other film bag, (2) pressing down the heated jaw for one or two seconds, (3) pausing for one to three seconds after raising the heated jaw so that the weld is properly set and firm enough to handle.

The timing will depend upon the

thickness of the film and the working temperature. By this procedure, it is claimed, seals can be made which are transparent, perfectly strong and flexible, yet completely hermetic.

CPE 491

Cast polyester blocks for high voltage transformers

Nearly 10,000 separator blocks cast in silica-filled bakelite polyester resin are being used in the manufacture of 100 high-voltage testing transformers destined for the export market. The polyester resin blocks have been specially designed for locating the winding formers and to ensure rigid clamping. The blocks are spaced equally around the perimeter of the winding formers, one above the other throughout the entire depth of the winding. Their use enables a considerable amount of external support and bracing to be eliminated, thereby appreciably reducing the man hours normally required for assembly, whilst at the same time adding to the efficiency of the design.

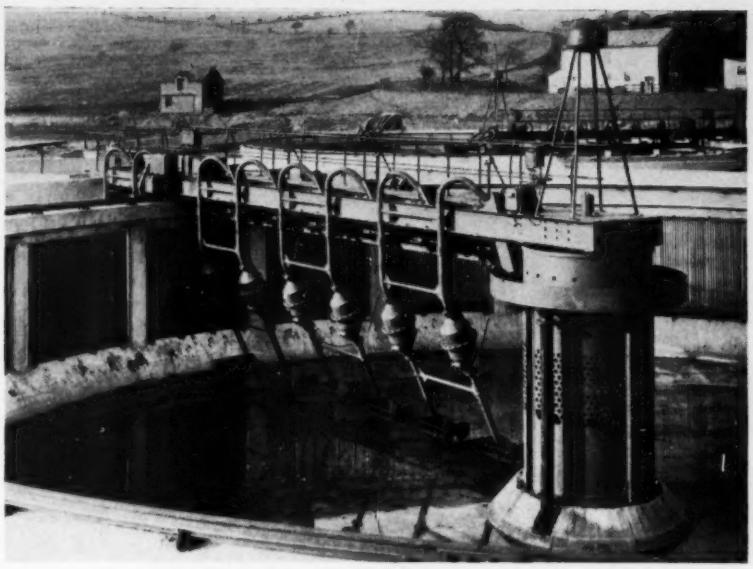
The transformer is a 150 kVA, 900/250,000 v. model intended for testing electrical equipment and insulation in power stations. The main body of the transformer is suspended in an oil-filled tank for cooling and insulating purposes. The complete unit weighs about 3½ tons.

Apart from its considerable mechanical strength, good electrical characteristics and resistance to the oil used for cooling the transformer, polyester resin has the advantage that the comparatively complex shaped blocks can be cast from it in one operation, thus avoiding the need for further finishing.

CPE 492

Gas filtration

A high-pressure gas filter filters contaminated gases in processing operations, thereby protecting costly operating equipment. Gas passes into filter at the bottom, is deflected by baffle plate and enters filter element at left. It passes through to filter element at right and leaves through outlet at top. Developed by a U.S. company, the new filter unit is particularly in demand in the manufacture of liquid oxygen where the filtration of abrasive dust-laden air is extremely important. **CPE 493**



Settling tank, showing dispersion drum, scrapers and pumps.

Settling tanks for trade effluent

The chemical industry gives rise to a great variety of effluents, each of which requires special study and treatment. Neutralisation of excessive acids or alkalis is often required and very often treatment by chemical precipitation followed by settlement in settling tanks.

A company which provides complete plant for this purpose, including averaging tanks, mixing tanks, lime mixers, *p*H control gear, percolating filters, pumps and flow recorders, produces a comprehensive range of circular settling tanks, designed to cover every requirement for the settlement of sewage and trade effluents.

The *Simplex* Type E tank illustrated is a general purpose tank, but particularly intended for the settlement and removal of primary sludges under positive control. The range of tank contents is 60,000 to 3 million gal. Spanning the tank radially is a rotating bridge, from which is suspended a series of vee-shaped sludge scrapers.

The liquor leaving the dispersion drum flows evenly and at a rapidly diminishing speed to the peripheral weir, the sludge falling to the flat floor of the tank and being collected in the scrapers. A simple submersible pump, arranged above each scraper, lifts the slurry, discharging it into a collecting pipe or channel along the rotating bridge.

CPE 494

High-speed electronic checkweigher

The rapid, accurate weighing of packaged goods while on the production line is one of the greatest needs of most concerns in the food, chemical, pharmaceutical, small goods and other industries, whose end production is a package containing solids or liquids.

A transportable electronic checkweigher has now been developed which weighs, instantaneously, rigid or packaged goods and enables an operator to handle up to a rate of 60 items/min. in the production line. Its weighing accuracy to British Board of Trade Specification is better than 0.2%. It has been designed for use by the unskilled operator and is intended for the semi-automatic production line and also, for high-speed percentage sample checkweighing on fully automatic, high-speed systems.

A considerable saving in labour and the more efficient use of capital equipment, it is claimed, can be made by the elimination of the 'dead-time' between the placing of each item on the conventional handweigher.

Another model in the same range is designed for incorporation into existing production lines of many types. It will weigh at the rate of up to 120

items/min. to better than 0.2%, being within the Board of Trade specification.

The product being weighed automatically operates, if necessary, an under-weight and overweight rejector or channelling mechanism, trend recorder and, if required, remote warning devices. If correct in weight, the product passes normally down the production line. **CPE 495**

Ultrasonic emulsification and dispersion

The latest model of a machine which applies ultrasonic technique to emulsification and dispersion incorporates an all stainless-steel pump and a union-coupled vibrating element.

The output of the machine is approximately 5 gal./min. Emulsification or dispersion is effected by the blade which vibrates at its natural frequency in the liquid stream leaving the jet form. The vibrations are inaudible to the human ear. Cavitation is taking place continuously in the volume swept out by the vibrating blade. Very high pressures are released locally and immediately made to work in the surrounding liquid without loss of energy usually caused by transfer from one medium to another. **CPE 496**

Chemical product for pitch control

A new product, which is a balanced formulation of calcium, iron and metallic iron sequestrating agents, inhibits the formation of pitch deposits by preventing, rather than by dispersing, the agglomeration of pitch particles in the making of paper and roofing and in processes where wood in defibrators is used.

The usage recommended for this product is 1 to 2 gal./ton as close as possible to the source of pitch, with care exercised to maintain it throughout the system so that it is always present at all points at which pitch may be generated or freed. Treatment should be continuous and it may be necessary to apply the product at more than one point to assure its presence. With this product the pitch maintained in semi-colloidal suspension does not adhere to the paper machine equipment but will accumulate in the white water. **CPE 497**

Standard impervious graphite heat exchangers now available in longer lengths

Tube and shell heat exchangers in impervious graphite are now available in the U.S. in 14 and 16 ft. lengths. These exchangers are produced from stocked component parts in sizes up to 650 tubes. The complete range of standard lengths now includes 3, 6, 9, 12, 14 and 16 ft.

The exchangers consist of a steel shell which houses a bundle composed of non-porous, graphite tubes. Where required, shells can be supplied in special alloys, *Haveg*, impervious graphite, or can be lead or rubber lined.

They resist the action of most corrosives, except a few strong oxidising agents. The manufacturer also claims that *Impervite* is virtually immune to thermal shock, and possesses a high rate of thermal conductivity.

The new longer lengths provide greater economy of space for a given amount of heat transfer surface, and also increase the number of increments of transfer surface available as standard. In addition to the longer lengths, all standard tube and shell heat exchangers are furnished with flush end nozzles for greater strength at this point and more positive fitting to piping. **CPE 498**

Low-pressure filtration

For low-pressure air and gas filtration, filters are available fitted with ceramic elements, different grades being used to suit particular applications. Pore sizes of this material range from 200 to 10 microns and in addition to standard material there is a special water resistant ceramic, which may be fitted to most types of the filter.

The ceramic usually employed for ordinary filtration purposes is *Porsilex*, which is claimed to provide maximum removal of solid impurities without danger of rupturing or channelling at any given pressure.

Although extremely effective in removing the bulk of moisture, the elements are designed essentially to ensure complete retention of liquid as well as solid impurities, the liquids retained being easily drawn off from the system without interruption of the service by means of a small drain cock. Cleaning of the elements is easily effected by a system of back-flushing or by removing the elements; the latter operation being easily accomplished owing to the advanced design of the filter bodies.

Compressed air filters fitted with *Porsilex* elements are said to have given years of excellent service in the supply lines of pneumatic instruments and tools, air chucks, fly presses, rubber mixers, moulding machines, paint spray guns, riveters and similar machines. In addition they are used in the filtration of gases used in the production of high explosives, of hot aluminium fumes, hydrogen, carbonic acid, ammonia and steam. **CPE 499**

Air and gas filter.

BAYONET HOSE COUPLING

A new hose to tap couling provides an instant, leakproof connection between hose and tap by just a twist of the wrist.

Basically, the upper portion of the coupling is fixed permanently to the tap and the lower portion is fixed to the hose; the two are coupled together in the same manner as a bayonet electric light bulb to its socket. **CPE 500**

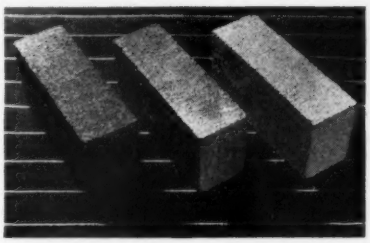
Low heat-storage insulating refractories

The use of a low storage insulating refractory as a hot-face lining in furnaces will substantially reduce heat losses, both by reduction in the heat actually stored in the brickwork, and by the very much lower conduction of heat through the material.

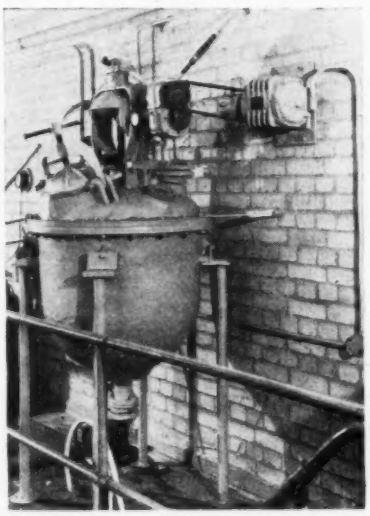
A range of such refractories achieves its greatest economies when used as a hot-face lining, with automatic temperature control. The range includes an M.I.28 model which can be used up to a maximum temperature of 2,800°F. and the outstanding characteristics of which are its low weight and thermal conductivity for a brick of such high refractoriness. For lower temperature work, the M.I.23 can be used at temperatures up to 2,300°F., either as a direct furnace lining under clean furnace conditions or as a backing insulation.

The most recently introduced of the M.I. range is the M.I.26, designed to fill the gap between the two former types. It is used at temperatures up to 2,600°F. Like the others, it can be used to greatest advantage as a fuel saver when it is at the hot face, but can be usefully employed as a backing lining when furnace conditions make hot-face application impossible.

CPE 501



Three types of refractory.



REDUCING SPEED

This Torque-Arm *speed reducer on a pressurised mixing vessel is one of a range whose scope has recently been extended. The type was introduced two years ago to solve the problem of dealing with drives requiring speeds of less than* 100 *r.p.m. at the driven end. Six single reduction units have now been added which are intended for the medium-speed range between* 100 *and* 240 *r.p.m. As these have a fixed speed ratio of* 5 *to* 1, *they are ideal for use with* 1,440-*r.p.m. motors to give (in conjunction with the V-belt drive) final output speeds in the* 90- *to* 375-*r.p.m. range.* **CPE 502**

New grease family

The *Molytone* grease family now being marketed has a wide field of industrial application. They solve many lubrication problems wherever two surfaces are in relative movement. This family is based on special *Bentone* greases containing molybdenum disulphide.

The temperature-resistance of *Molytone* grease enables machinery to be operated continuously at as high a temperature as 450°F. For short periods lubrication continues satisfactorily at even higher temperatures.

The pressure resistance gives positive lubrication at 100,000 p.s.i. working pressure. Thus high pressure working conditions, which would normally cause wear, sticking, or seizure may be countered.

There is no melting point. The grease can be used in conditions up to the point of inflammability of the basic oil.

The excellent water-repellent property allows *Molytone* grease to be used in high pressure steam atmospheres and other wet conditions without impairing its lubricating properties.

Molytone L.M. grease, containing a higher molybdenum disulphide content, is designed for the lubrication of gas cocks, plugs and valves, particularly where much heat is experienced. It has, also, many applications as an anti-seize grease, particularly where sealing at high temperatures is required. It can be used for the prevention of freezing and fretting of static parts fitted together or under semi-static conditions.

Another grease, *Molytone X*, has a special application as a rubber lubricant. Its solvent-resistance is particularly good against petroleum solvents and it is also water repellent.

CPE 503

Anti-corrosive paints

The recent introduction of surface coatings based on the new epoxy resins has brought about a striking advance in the fight against corrosion in chemical plant.

A new E.P.C. 1500 range of protective coatings now being marketed has already given successful results and the series is being manufactured in a large number of formulations to cover a wide range of applications.

Surfaces in severely corrosive atmospheres which have been protected with E.P.C. coatings have still been in good, if not perfect condition some four to five times longer than the time in which a normal paint or varnish had suffered complete breakdown.

CPE 504

Combined metal sorter and resistivity measurer

The sorting and identification of non-ferrous metals and alloys by means of a handy, portable, lightweight, battery-operated instrument, which is easy to read and operate, is a need of most engineering, electrical and metallurgical industries and maintenance men in almost every industry where machinery and other plant are employed.

A metal sorter and resistivity test set which has been designed to meet this need is, therefore, an essentially practical instrument for use by storekeepers, fitters, foundrymen, toolmakers, press operators, machinists and others, with little or no electrical or electronic knowledge.

The instrument is operated by dry batteries and may be used in open-air stockyards and scrap metal yards or anywhere else where there is no electricity supply. It consists of an investigating head on a lead, which is plugged into a small instrument case.

The test heads are interchangeable and designed to ensure that changes

of ambient temperature do not cause drift, or in other words, affect the readings of the instrument.

The head is placed on the metal surface, which need not necessarily be flat, because the measurement of the resistivity of a metal is not critically dependent on the spacing of the head from the surface of the metal under investigation.

Identification is based upon the specific resistivity of the particular metal. Because this is a physical constant of which every metal and alloy has its own specific value, its measurement gives a figure which identifies the metal being tested.

Provided the metal or alloy has a specific resistivity between 1.0 to 28.0 micro-ohms per centimetre cube, it may be measured, or, inversely, the metal or metals distinguished or sorted.

CPE 505

Double-beam spectrophotometer

Designed primarily for use by the organic chemist at his bench, a new low-cost double-beam spectrophotometer produced in the U.S. has considerable versatility. It may be used for fast purity checks of raw materials, for recording the progress of an organic synthesis, for molecular structure elucidation and for precise quantitative analysis.

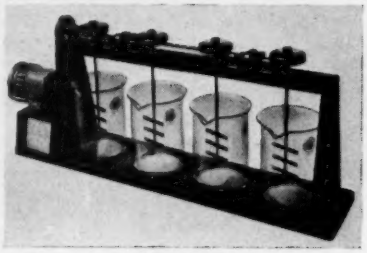
A background of infra-red instrumentation is not necessary to operate this new instrument. Operation consists of putting a piece of chart paper on a drum, inserting the sample and pushing a start button. The unattended *Infracord* spectrophotometer will then record a permanent record, on $8\frac{1}{2} \times 11$ in. paper.

The instrument scans a spectral range from 2.5 to 15 microns. Resolution is 0.05 microns at 10 microns.

CPE 506

Laboratory flocculator

With a laboratory flocculator which has recently been developed and which should be of interest to chemists, water, sewage and effluent plant superintendents, up to four small-scale treatment tests can be carried out



Flocculator

simultaneously when, for example, the problem of modifying the chemical treatment of a liquid while at the same time maintaining a high quality effluent has to be considered.

This procedure is not always feasible on the actual plant as it invariably involves delay and wastage of chemicals while the correct dosage is being determined. The flocculator has therefore been designed to fulfil all requirements for 'jar' tests which are likely to be encountered in normal laboratory practice and is particularly valuable when deciding upon a treatment for supplies of variable quality.

The instrument consists of a black enamelled pressed steel frame from which are suspended four stirrer paddles driven by a small geared electric motor mounted on a platform at one end of the frame. The whole is fixed to a black base of chemically resistant material.

The motor with a normal output speed of 45 r.p.m. gives the paddles a range of 6 to 19 r.p.m. with one pulley setting and 20 to 60 r.p.m. with the other. The speed of each paddle can be individually regulated.

It is claimed that the initial outlay can be speedily recovered by the economy in chemical reagents effected in the plant through the carrying out of periodic tests. **CPE 508**

Diffusion in a power station and a brewery

Ceramic cylinders used for aeration and diffusion purposes are claimed to reduce reaction time by providing a denser stream of small air bubbles and therefore a larger surface of gas contact for reaction purposes.

A range of diffusers and generators which can be applied to many branches of industry has been used at a power station which was fitted with batteries of elements for the neutralisation of the scrubbing water used to purify flue gases. Aeration of the acid formed is accomplished speedily with these diffusers and enables the neutralised effluent to be discharged directly.

A somewhat different example may be found at a brewery where each

Diffuser adjacent to an impeller in a maturation tank.

maturation tank is fitted with a diffuser element, adjacent to the mixing propeller. The maturation time is very considerably reduced by this method of speeding reaction. **CPE 509**

Economical measurement of large fluid flow rates

Designed to permit economical measurement of large fluid flow rates in pipe sizes of 2 in. and above, a new rotameter measures a by-pass flow instead of the static differential pressure across a main line orifice plate. It permits fluid flow to be directly observed and the actual main line flow rate reading continuously indicated.

Because the by-pass flow and the main line flow are proportional in the first degree, the rotameter scale is linear. Seal pots and overload checks are eliminated. Because a small part of the main line fluid passes continuously through the meter, a constant purging action is obtained. Corrosive fluids are readily handled, since wetted meter components can be supplied in any machineable material required.

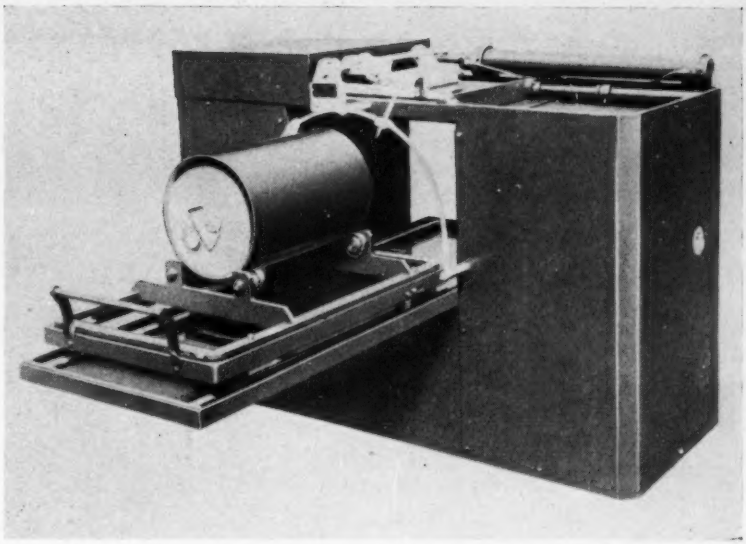
CPE 507

Pneumatic timers for d.c. supplies

The operating principle of a new pneumatic timer for d.c. supplies is based on the interval required to transfer a small volume of filtered air from an upper to a lower chamber through a regulated orifice. A knurled knob gives adjustment from 0.2 sec. to 3 min. in an infinite number of steps.

The basic pneumatic unit, it is claimed, is so designed that it is virtually impervious to fluctuations in atmospheric pressure and ambient temperature.

It is also flexible, as simple adjustments enable the time setting to be varied and also to convert the device from time delay after energisation to time delay before energisation or *vice versa*. One or two auxiliary switches operating directly from the timer magnet can be fitted and normally consist of a double circuit contact mechanism. **CPE 510**



'Rondec,' model 303 silk screen drum badging machine, showing position of the drum to be marked. The drum slides forward on the carriage for printing and returns automatically.

Push-button scale solves adhesive weighing problem

Automatic, distortion-free weighing of difficult adhesive materials is provided by a newly designed gross weigher announced in the U.S. Automatic features of the scale include push-button control, automatic feed and bin level switches, and a choice of power feed mechanisms.

The new scale, called the E-52, feeds directly into a bag suspended from the weigh beam, rather than through a weigh hopper. This keeps material continuously in motion until it falls into the bag, eliminating material build-up and erratic discharge, according to the makers.

Besides handling such adhesives as carbon black, powdered sugar, powdered milk and starch, the new gross weigher will accommodate non-adhesive feeds, meal, food products and chemicals. It handles 25 lb. to 100 lb. bags at normal operating speeds of five or six bags/min. Accuracy is reported at an average of 1 to 2 oz.

The scale also has a head-room requirement of only 3 ft., excluding feed arrangements, for installations where low head-room is a limiting factor.

Other features include: dust-tight construction of weighing components and controls; a manually-operated dust-tight bag-holder; accessibility of all electrical and mechanical components for quick inspection and maintenance; and a choice of feeding arrangements, depending on the material being handled.

CPE 511

Asbestos roof paint

The advantage of a new paint product is that it may be applied direct to both new and old asbestos roof surfaces without there being any need to apply any pre-sealing or neutralising treatments. The reason for this is that *Pitan* asbestos roof paint is completely unaffected by any free alkali in the asbestos. It is also acid resistant.

In one establishment, the roof treated was absolutely black, and the whole shop was hopelessly dark, and powerful lights had to be burned all day. Since painting, work is carried out all day by natural light.

The system adopted, after cleaning, was quite simple, merely involving direct application to the asbestos roof of one priming coat and one finishing coat of the new paint.

CPE 512

DRUM PRINTING

A silk screen badging machine has been specially designed for printing on 5 to 10 gal. cylindrical containers such as drums. It is stated by the manufacturers that with one operator 250 to 300 impressions per hour can be produced. The machine is fitted with silk screen with a maximum type area of 10 in. × 10 in. and the drums can be filled 2 to 5 min. after printing. The mechanism of the *Rondec*, model 303, is operated from any compressed-air line with a pressure of 30 p.s.i. The machine is guaranteed for two years. **CPE 513**

Hydrogen content meter

One of the main problems connected with the production of aluminium castings is the presence of hydrogen, and it is of course essential that the gas be detected and measured in order to preserve the quality of the final melts. A *Telegas* tester for this purpose has been developed and is now in production.

The instrument is intended for foundry floor use, being compact and portable. It may be held in one hand while a direct reading is obtained by the simple dipping of a probe in the melt and the turning of a handle for

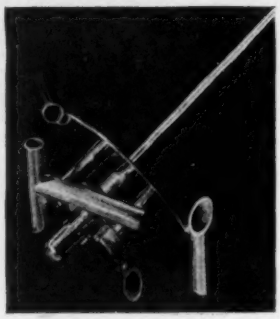
two or three minutes. The apparatus is entirely self-contained and no sampling of molten metal is required.

CPE 514

Mixing device

Covering a number of operations such as the manufacture of solutions, the mixing of liquids with solids, the mixing of liquids of varying viscosities, and the preparation of emulsions, a machine called an *Impelator* not only sets in motion the media to be mixed but also combines centrifugal force, suction and shearing action and counter-current whirl. This combination, while creating an efficient intense mixing zone, is also claimed to promote a very high velocity of flow through the entire vessel and to ensure maximum dispersion with minimum particle size.

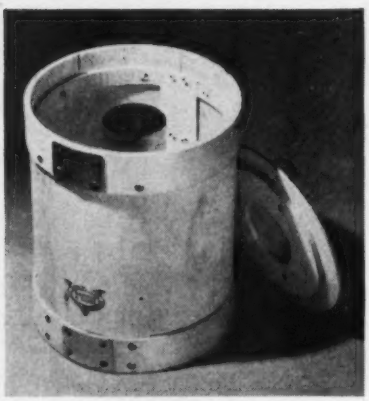
The machine consists of a number of small conical tubes mounted round the periphery of a set of discs. One set is fitted to the bottom of a vertical rotating shaft and, above this set, adjustable up or down the same shaft, is assembled a second set. Others are added according to the height of the vessel in which the operation of mixing, etc., is to be carried out. The conical tubes are set at such an angle that controlled turbulence in an upward and downward direction is created.



"Impelator" machine.

The liquid, or mixture of liquid and solid, which is passed through the tubes during rotation, impinges on the already moving bulk of the mass which produces a rapid shearing action between the particles of each of the materials and rapidly achieves an extremely well dispersed and homogeneous mixture of minute particle size. The downward and upward current due to the angle at which the tubes are placed enhances turbulence and flow. The lower tubes of the lower set of discs cause a powerful downward flow, preventing the formation of a sediment at the bottom of the vessel.

CPE 515



PACKING RADIOACTIVE POWDER

Radioactive powder is packed in 5-gm. bottles, four of which are wrapped in cotton wool and placed in a small metal can. This can is cushioned by two rolls of corrugated paper and packed inside the metal sleeve depicted in this barrel. The sleeve is held firmly in a vertical position by plywood collars rivetted to the inner surfaces of the barrel's bottom and lid. The combination of protective materials plus the air gap inside the barrel provides an effective and consistent screen against radiation.

CPE 516

RECENT PUBLICATIONS

Lime hydrating. A fully illustrated, 24-page booklet published by Sturtevant Engineering Co. Ltd., Southern House, Cannon Street, London, E.C.4, describes the Sturtevant-Knibbs process of lime hydration. The various items of plant—rotary crusher, hammer mill, hydrator, air separators, weighing and bagging machines—are also shown in some detail.

Industrial pumps. The latest technical publications from Rhodes, Brydon & Youatt Ltd., Waterloo Engineering Works, Gorsey Mount Street, Stockport, are a revised and enlarged issue of a pamphlet on the chemical process *Mopumps* and one dealing with the new 350 series of vertical high-temperature *Mopumps*. The former are of the horizontal, single-stage, centrifugal type, and are made with inlet bores of 2, 3, 4 and 6 in. diam. The latter type, while primarily a high-temperature water circulating pump, is intended to have numerous applications in industrial process work.

Ultrasonic materials. A brochure on this subject has been issued by Technical Ceramics Ltd., Woo Burcote Way, Towcester, Northants.

Nickel plating. Written primarily for engineers, designers and others who interested in the possibilities which plating offers in design, a new publication of the Mond Nickel Co. Ltd., Thames House, Millbank, London, S.W.1, includes a description of surface preparation in general and for zinc-base alloys, aluminium and nickel-chromium-iron alloys in particular. Commonly used solutions, relevant plating procedures to maintain high-quality work, plant required, mechanical properties of deposits and methods of testing deposits are all dealt with in a highly compressed text.

Diesel engines. Davey, Paxman & Co. Ltd., Standard Ironworks, Colchester, have issued publication No. 1511 describing the operation of Paxman diesel-engined locomotives working in steelworks. The change over from steam to diesel locomotives is necessarily gradual, and this summary of the operating figures and information which have been amassed over a number of years will be of interest to those responsible for operating shunters, particularly in the heavy industries. The figures quoted are based mainly on operational data obtained both in Britain and overseas.

Steel standards. Two publications dealing with the mechanical properties of steel at elevated temperatures have been published by the British Standards Institution, sales branch, 2 Park Street, London, W.1. One deals with wrought carbon steel (0.08 to 0.25% carbon) and the other with wrought 1% chromium, ½% molybdenum low-carbon steel. They are priced 2s. 6d. and 3s. respectively and were originally intended for the use of committees of the Institution in preparing standards, but were made generally available at the request of industry.

Careers for graduates.—A short brochure, which is intended to indicate to graduates considering a career in the chemical industry, the scope and style of operations and the opportunities of the firms concerned, has been issued by Albright & Wilson Ltd., 49 Park Lane, London, W.1, and Midland Silicones Ltd.

World News

CHEMICAL SOCIETY REFERENCE LIBRARY BURLINGTON HOUSE, W.1
UNITED STATES

MEXICO

Frasch process sulphur plant

Negotiations have been completed for construction of a $3½-million Frasch process sulphur plant in Mexico for Central Minera S.A. by Fish Service de Mexico S.A. Central Minera, a subsidiary of Texas International Sulphur Co., which owns a 123,000-acre sulphur concession in southern Mexico's Isthmus of Tehuantepec.

The proposed new facility will have a capacity of about 1,000 tons/day, with completion expected by March 1, 1958. Both rail and water transportation facilities are said to be accessible to the sulphur concession, facilitating construction and operation of the plant. In addition to building the plant, Fish will maintain active management control of the operation.

JAPAN

New uranium refining process

A Japanese scientist in a Ministry of International Trade and Industry research centre has claimed that a new process for refining uranium ore of poor quality has been developed. Further tests are being carried out. The new process is called an 'evaporation method of uranium extraction through chlorination.' Pulverised ore is heated to between 700 and 800°C. in a furnace through which a mixture of chlorine and carbon monoxide gases are then blown. Metallic uranium is extracted from the resulting uranium chloride vapour by the usual electrolytic method.

Industrial production outlook

A survey made by the Ministry of Trade predicts that Japan's industrial and mineral production will reach 300% of the pre-war level in the 1960 financial year. The production index for the 1955 financial year was 187.7, with 1934-36 as the base period.

According to the survey, production of some of the principal commodities in the 1960 financial year is expected to reach the following figures (in thousand metric tons except where otherwise stated, with the estimates for the current financial year in brackets): Petroleum products, 16,440,000 kl. (10,400,000 kl.); aluminium (primary), 122 (67); titanium, 5,025 tons (2,675 tons); nickel, 10,500 tons (6,582 tons); sulphur, 270 (255); cement, 16,000 (13,000); ammonium sulphate, 4,421 (3,250); calcium cyanide, 660 (547); superphosphate of lime, 2,500 (2,252); carbide, 1,167 (793); sulphuric acid, 4,825 (3,890); caustic soda, 425 (368); pure benzol, 103,796 tons (55,039 tons); vinyl chloride, 120,400 tons (66,000 tons).

PORTUGAL

Trichlorethylene

The Belgian-controlled large chemical manufacturing firm of Soda Povoa S.A.R.L., Povoa de Santa Iria, near Lisbon, has begun to manufacture the important solvent trichlorethylene.

CUBA

Paper from sugar cane

Plans have been announced for a pulp and paper mill in Cuba which will use bagasse—crushed and juiceless sugar cane—as raw material. The mill, expected to start operations in mid-1958, will cost between $12 million and $14 million. Undertaking the project is a new company, Papelera Pulpa Cuba S.A., whose principal owners are leading industrialists in Cuba.

Parsons & Whittemore Inc., of New York, will supply the machinery and also assist in design of the mill. The new mill will be the largest facility of its kind in the world and will represent a major step toward increased use of bagasse, instead of wood, as raw material for pulp and paper manufacture.

GREECE

Plans for nitrogen plant

Representatives of two West German industrial firms, the Badische Anilin Soda Fabrik and Friedrich Unde, Dortmund, are studying the possibilities of constructing a nitrogen plant in Greece.

French interests are also making inquiries at the Greek Ministry of Co-ordination, which is handling bids for the construction of such a plant.

CHILE

Sulphuric acid project

The Braden Copper Co. has requested government authority to build a new sulphuric acid plant at El Teniente mine at a cost of $U.S.3 million. Daily output of acid will be increased, when the new plant comes into operation, from 50 to 70 metric tons.

Uranium ore reserves

Following the recent reports that Britain, Canada and the U.S. had agreed to release atomic information previously regarded as secret, figures relating to the uranium ore reserves of the U.S. and Canada were made public for the first time in Washington and Ottawa.

It was announced that the U.S. produced 3,750,000 tons of uranium ore in the past 18 months, and reserves were estimated at 60 million tons. An important increase in the production of uranium oxide, the partly refined raw material of nuclear fuels, was disclosed. The annual rate is now 8,000 tons.

The Federal Government in Ottawa put its reserves at 225 million tons of ore with a uranium content of 237,000 tons. This figure means that Canada has vast quantities of uranium in excess of requirements for the domestic atomic energy programme. In the past, Canada has exported uranium ore only to the U.S., but it is expected that ore will now be shipped to Britain, Japan and other countries lacking supplies of their own.

New chemical plant for Mississippi

H. K. Porter & Co. Inc. has announced plans to build a chemical plant in Pascagoula, Mississippi, to produce magnesia and basic refractory products. Cost of the plant, whose completion is scheduled for early 1958, will be $8 million.

It will be located on a 400-acre tract on the proposed new deep-water channel currently being constructed by the Jackson County Port Authority of Pascagoula. This channel will provide docks and access to ocean-going vessels drawing up to 32 ft.

The Porter Co. at present operates 12 divisions, two of which produce silica and clay refractories. The new products would be an expansion of the firm's refractories business.

Ferro-alloys plant

The Ohio Ferro-Alloys Corp. will build a new ferro-alloys plant near Clarington, Ohio, on the Ohio River. The plant, estimatedly costing more than $3 million, will have three large electric furnaces of the latest design. The layout of electric facilities and other related equipment will be arranged so as to allow for trebling capacity of the plant in the future, if desired.

The new unit—the fourth plant of the company—will produce silicon

alloys for the aluminium, steel and chemical industries. It will serve new aluminium reduction plants now under construction along the Ohio River and will be close to the steel-producing centres of the upper Ohio River.

The company hopes that the new unit will allow it to expand production of chromium alloys for the stainless-steel industry at its existing plant at Brilliant, Ohio. Ohio Ferro-Alloys produces a full line of silicon, manganese and chromium alloys.

U.S. rights for pickle liquor process

Exclusive rights in the United States and Canada to a commercial process for recovery and regeneration of pickle liquor—a solution used in cleaning impurities from the surface of finished steel—have been obtained by Koppers Co. Inc.

Developed by a West German chemical engineering firm—Zahn & Co.—the process is a commercial implementation of a technique patented by the Inland Steel Co. and assigned to Koppers. Under the agreement, Koppers will make available the design and operational data of three European commercial plants now using the process.

Celanese to build new chemical plant

The Celanese Corp. of America is to build a new acrylate ester plant in Pampa, Texas, according to Mr. R. W. Kixmiller, vice-president and general manager of the Celanese chemical division.

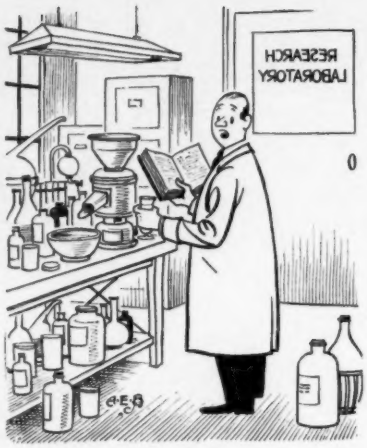
With a capacity of 15 million lb. of acrylic acid esters p.a., the plant is expected to start production during the last quarter of 1957.

The new plant is the latest step in the company's chemical expansion programme, which also includes the recent completion of a new plasticiser and functional fluid plant in Point Pleasant, West Virginia, and construction of a new polyol production unit in Bishop, Texas.

Alcohols and other materials currently in production by Celanese will provide raw materials for the Pampa acrylate plant. The plant's output will include a wide range of acrylic acid esters, including methyl, ethyl and butyl acrylates.

Phosphate fertiliser plant

Designed for an eventual annual output of approximately 100,000 tons of phosphate rock and 30,000 tons of calcium metaphosphate, an ambitious fertiliser plant is now in course of preparation in the Georgetown Canyon



"HAVE WE GOT SUCH A THING AS THE EYE OF A NEWT, WILLOUGHBY?"

in south-eastern Idaho, U.S. The project, which is being carried out by the Central Farmers' Fertilizer Co., of Chicago, includes the recovery of phosphate ore and its processing into phosphate plant food.

Heavy earth-moving equipment is being employed for the first phase of the project which comprises the construction of a seven-mile-long railway with a parallel access road. Important units of the proposed manufacturing area will include an electric furnace, a phosphoric acid plant and an end-products plant to produce metaphosphate. The materials will be sold for use in the production of mixed fertilisers.

TURKEY

Completion of sulphuric acid plant

A sulphuric-acid plant attached to the copper refinery at Murgul was completed in October at a reported cost of £T12½ million, with an annual capacity of 70,000 tons of acid. An extension is planned.

German investment

Turkish and West German interests have signed an agreement for the joint exploitation of wolfram in the Ulu-Dag area near Turkey, according to a semi-official announcement recently in Ankara.

The agreement, which was signed by Turkey's Eti Bank—a holding company for mining affairs—and Krupp, of Germany, and which provides for the formation of a Turkish-German company, is subject to ratification by the Turkish and German governments. Krupp, says the announcement, will supply machines and other equipment for the undertaking.

GREAT BRITAIN

Synthetic ammonia plant reconstructed

The synthetic ammonia plant of Nitrogen Fertilisers Ltd. at Flixborough, near Scunthorpe, Lincs., which produces ammonium sulphate for use in the fertiliser industry, recently underwent successful reconstruction.

A new roaster, of what is claimed as a unique rotary design, developed by the company itself, has been installed and will burn impure sulphur which results as the filter cake from the bright sulphur purification process.

A complete new converter unit has been supplied and erected by the Power-Gas Corp. Ltd., of Stockton-on-Tees, who are exclusive licensees in this country for sulphuric acid plant designed by Chemiebau Dr. A. Zieren GmbH.

A feature of the erection programme was the necessity to keep the existing plant in operation as long as possible so as to avoid a serious interruption in acid production. This was accomplished by erecting a new single-shell 140-ton/day monohydrate converter in the space occupied by one of the two old 60-ton/day units.

The reconstructed plant is now in successful operation and the converter unit has comfortably exceeded the guarantee of 140 tons output at 98% conversion efficiency.

Northern Ireland fibre plant

The Governor of Northern Ireland, Lord Wakehurst, recently turned the first piece of earth at a ceremony marking the opening of the site of the $3½-million *Acrilan* chemical plant to be built at Coleraine, near Londonderry.

The company manufacturing *Acrilan* synthetic textile fibre is the American concern, Chemstrand Ltd., who awarded the contract for the complete design and construction work on the plant to Costain-John Brown Ltd., of London.

The plant will be completed by the beginning of 1959 and is designed to produce 10 million lb. of *Acrilan* fibre each year during the first stage of operation.

Instrumentation and automatic control

A course of lectures is being held at Bradford Technical College on 'Instrumentation and Automatic Control in the Chemical and Process Industries.' Lecturers include representatives of instrument-manufacturing firms.

BAHRAIN

Water-desalting plant

What is claimed to be the largest plant in the world to purify salt water electrically is on stream at Bahrain. The plant has been installed by the Bahrain Petroleum Co. Ltd., a member company of the Caltex group, to produce 86,400 gal./day of fresh water to supply the needs of a community of about 5,000 persons in Awali, near the Bapco refinery.

The plant was manufactured by Ionics Inc., of Cambridge, Mass., and consists of 15 basic desalting units connected in three parallel banks of five series units. In the series, each of the five units removes up to 40% of the salt present at the beginning of the cycle, so that input water of 3,100 p.p.m. of dissolved solids is converted to produce water of less than 450 p.p.m.

The desalting plant is automatic in operation. The principal operating costs are electricity and occasional replacement of thin plastic membranes, of which 4,500 are used in the plant.

FRANCE

Uranium resources

M. Guille, Secretary General of State for atomic energy, estimates French resources in uranium to be between 50,000 and 100,000 tons. Of this figure, 10,000 tons have been verified by direct investigation.

In Madagascar, 1,000 tons of thurianite have been found containing 10 to 12% of uranium and 60 to 70% of thorium. Prospecting is going on in the Sahara, French Equatorial Africa and Guyane.

Prospects for the immediate future of uranium production in France are: 1958, 500 tons; 1961, 1,000 tons; 1970, 2,500 tons; 1975, 3,000 tons.

Staff needs for the uranium programme will be about 7,000 persons in 1975, of whom 400 will be engineers. Another 60 milliards francs investments will be necessary, in addition to the 20 milliards already invested.

A factory for the chemical treatment of uranium is to be built at Bessines in the Haute Loire, where there are rich deposits of uranium ore.

Phosphates industry

A 1,000-million-franc subsidy has been earmarked for the phosphate fertiliser industry in 1957 by the French Interministerial Economic Council.

The subsidy will enable the industry to maintain its current prices despite the increase in imports of North African phosphates (which became effective on January 1) and the higher freight charges.

Last November, the industry threatened to stop deliveries unless it was allowed to reflect these higher costs in its sales prices.

The Leonard Hill Technical Group—February

Articles appearing in some of our associate journals this month include:

Petroleum—Oil Geology of Europe; Oilfields of Holland; Search for Oil in Australia; Polymerisation of Light Hydrocarbons; Marine Search for Oil; Cutting Oils.

Corrosion Technology—Application of a Systematic Scheme for Examining Corroded Metal Specimens; Anti-Corrosion and Anti-Fouling Paints for Ships' Hulls; Combating Heavy Fuel Corrosion and Cylinder Wear in Marine Boilers; Caustic Cracking; Silver in Chemical Plant Construction.

Automation Progress—Fully Automatic Arc Welding; Ultrasonic Drilling, Part 1; Instruments for Scanning of Variables; American Trends in Automation; Trends in Automatic Milling and Baking; System Control and Protection of a Nuclear Power Station.

Manufacturing Chemist—Chemicals from Petroleum; Alkyl Halides; Fatty Acid Alkylolamides; Restrictive Trade Practices Act.

Fibres—Search for and Production of New Fibres, Part 2: Polyvinyls; Heat Transmission of Fabrics: The Effect of Certain Physical Characteristics, Part 1; American Experiments in the Chemical Treatment of Hard Fibres; Tracing 'Dirt' in Soiled Clothes by Radioactive Carbon.

Dairy Engineering—Bottle Filling and Capping; Milk Cartoning in the Smaller Dairy; Progress of 'Tetra Pak' Cartons; Planning the Medium-Size Dairy; Denmark's Dairy Industry.

Food Manufacture—Milk Powder Manufacture; Annual Reviews: Meat, Dairying, Milling, Fruit and Vegetables; Malt Vinegar Production; Keeping Qualities of Fruit and Vegetable Concentrates; Estimation of Ascorbic Acid in Foods.

Muck Shifter—Hydraulic Power in Earth Moving; Concrete Mattress Prevents River Erosion; Contractors and the Present Oil Crisis; Results of Modern Research Employed in 250 Miles of Highway Construction; Compressed Air Shield Driven Tunnels.

Building Materials—Protective Paints for Varying External and Internal Conditions and for Various Materials; Reducing the Cost of Dressed Stone—New Methods, Machines and Techniques.

Floors—Tiles for Flooring, Part 1: Hard Tiles.

World Crops—Aerial Spraying Studies; Ultra-Low-Volume Spraying in Africa; Olive-Leaf Spot Disease in Cyprus and its Control; Report on the Third British Weed Control Conference; Weed Control.

Mexican nitric acid project

Saint-Gobain and Batignolles-Chatillon have placed with the engineering division of Société Belge de l'Azote et des Produits Chimiques du Marly (S.B.A.), Liége (Belgium), a contract for the design of the nitric acid plant to be installed in the complex for the production of nitrogenous fertilisers realised at Monclova (Mexico) by a group of French and Mexican companies.

S.B.A.'s own nitric acid process will be used in this plant. This process is applied in the works of this Belgian company as well as in several plants S.B.A. has designed for foreign firms.

PAKISTAN

Iron and steel plant

The Pakistan Government's planning commission has approved a plan to establish an iron and steel plant in the country and has accepted the Krupp-Renn process as technically sound.

The plant, to be built at Multan, will have an initial capacity of 69,000 tons of billets.

Fertiliser needs

The Pakistan Government has accepted the recommendation of the Agricultural Conference to import 675,000 long tons of fertilisers worth 230 million rupees by March 1960.

The conference estimates East Pakistani annual needs at about 60,000 tons over the next three years, while West Pakistani requirements are expected to rise from 100,000 tons to 125,000 and 150,000 tons during that period.

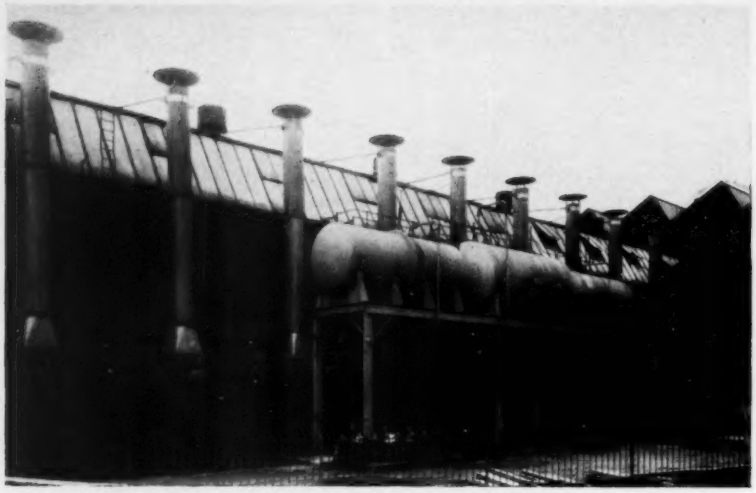
The setting up of a new fertiliser factory in West Pakistan with a capacity of 200,000 tons and a 100,000-ton factory in East Pakistan was said to be under consideration.

A plan put forward by the Pakistan Industrial Development Corporation under which total Pakistani annual production capacity of fertilisers was to be raised to about one million tons has been shelved as it was considered too ambitious.

ISRAEL

Steel plant

The first furnace of the steel-melting plant in the 'Steel City' near Acre, northern Israel, has been completed. The furnace is one of two open-hearth German-made Siemans-Martin furnaces, with a melting capacity of 40 tons, which are to provide steel billets for the adjacent rolling mill. The steel will be manufactured from local scrap with the addition of



PVC STACKS FOR THE EXTRACTION OF NITRIC ACID FUMES

Eleven PVC chimney stacks were recently completed at a stainless-steel manufacturers in Stocksbridge, Yorks. PVC was selected as the material for these stacks because of its excellent resistance to corrosive fumes and because it has a very satisfactory appearance. The PVC manufactured under the trade name of *Cobex* was supplied by BX Plastics Ltd.

imported pig iron. Later it is planned to exploit the iron-ore deposits at Manara, Upper Galilee.

The 'Steel City' will eventually consist of five large, modern plants covering an area of 200 acres. When completed, they will produce pig iron, mild steel, and rolled-steel products.

Potash production

At the Dead Sea works, the management of which has been handed over entirely to the Fertilisers & Chemicals Co., of Haifa, production of potash rose in October last to 6,000 tons. It is hoped that output this year will reach 80,000 tons.

WESTERN GERMANY

Ethylene oxide plant

The Farbenfabriken Bayer chemical combine at Leverkusen is to set up a new plant to produce ethylene oxide with a capacity of about 12,000 tons p.a.

The company said that the plant would be built by the Scientific Design Co., New York. It would work on the basis of direct oxidation of ethylene, a production process developed by the American firm.

The output of the plant is to be used for further processing in other Bayer plants, chiefly in the production of esters and ether.

Increased polythene output

The annual output of polythene from the Rheinische Olefinwerke, Wesseling, near Cologne, is to be raised from 10,000 tons to 35,000 tons in the course of the next three years. This has been decided upon in view of the favourable market which polythene is finding in Germany.

Bavarian atomic energy programme

The Maximilianschütte A.G., through its subsidiary company, the Gewerkschaft Werra, Weissenstadt, claims to have developed a method of processing uranium ore which leaves only 2% waste. Bavarian ores enriched to date are expected to supply the reactors already planned with uranium fuel for five years.

Plastics industry

West German production of plastics was expected to rise to about 500,000 tons in 1956, which is about 20% more than in 1955, according to industry sources.

Sales of plastics were expected to increase to 1,400 million marks' worth from 1,200 million in 1955.

Exports were expected to amount to 350 million marks last year.

Graphite production

The graphite works in Kropfmühl is said to have succeeded in mining a 46% graphite which can be purified to almost 100%. It is hoped that Kropfmühl will be able to produce 100 tons/month of graphite.

INDUSTRY REPORTS . . .

Machines for thermoplastic materials

In the speech of the chairman at the annual general meeting of R. H. Windsor Ltd. it was revealed that considerable sums had been expended upon development of new types of machine particularly designed to deal with the new thermoplastic materials which have emerged recently.

It was pointed out that the plastic industry as such has changed its character in the last five years and that the products of the industry are increasingly contributing essential parts of industrial complexes.

Chemical plant extensions

Despite fluctuations in sales and the price of raw materials such as waste rubber, the Rubber Regenerating Co. Ltd. was able to report increased turnover and a trading profit at its annual general meeting. Rubber compounding had been terminated during the year, but the chemical plant had operated overtime and provided increases in both sales and production. The reclaim extension has been completed, as has the expansion of the chemical plant, where improvements in technique are constantly being sought.

New Canadian chemical plant

A report to the stockholders of Shawinigan Chemicals Ltd. revealed that the company is engaged in an extensive programme of capital expenditures, which include a new carbide furnace and the sulphuric acid and chlorine-caustic soda plants at Shawinigan Falls and a vinyl acetate plant at Hull, England. The carbide furnace and sulphuric acid at Shawinigan Falls have now been placed in operation, and construction of the chlorine-caustic soda plant has been started.

Pelleting machines

Horizontal hydraulic pelleting machines are to be made by the Logan Engineering Co., of Chicago, for sale in America under licence from British Industrial Plastics Ltd. These machines are made in Britain by B.I.P. Engineering Ltd.